

Green Schoolyards in Rotterdam: a gendered and multi-scalar analysis of children's perceptions.

Bobet Kloosterman

Supervisor: Mattias de Backer

Master thesis presented in fulfilment of the requirements for the degree of Master of Science in Urban Studies (VUB) and Master of Science in Geography, general orientation, track 'Urban Studies' (ULB)

Date of submission: 1st June 2025

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ABSTRACT

Children's voices remain underrepresented in many domains, even regarding schoolyards. Existing research highlights the importance of green schoolyards and indicates the role of gender dynamics frequently prevalent in schoolyards, with boys dominating the space (van den Bogerd & Maas, 2024; Pawlowski et al., 2019). However, prior studies tend to observe children, whereas this thesis explores children's perceptions concerning quality and safety in their schoolyards, by asking them to create a fuzzy cognitive map of their key elements. Thirty-five children, attending either a school with an enclosed, green schoolyard or an open, concrete schoolyard were interviewed. They were between 8 and 13 years old and 62% were girls. The results suggest that children prefer elements from their schoolyard, recognise the importance of social factors and the presence of (known and unknown) adults. These perceptions also differed between boys and girls, supporting earlier research that these groups prefer different activities, but that this can be mitigated in green schoolyards (Reimers et al., 2018, Nicksic et al., 2018). Openness was found to be an important factor, with children from the enclosed school preferring more openness and children from the open schoolyard favouring additional fencing, due to safety concerns. The implications of this thesis extend beyond individual playground equipment, advocating for a multi-scalar approach that incorporates the schoolyard, the school and the neighbourhood, to do justice to children's experiences. The scenarios modelled highlight that adjusting schoolyard design is a complex task, due to the interconnectedness of each element.

Keywords: green schoolyards, gender dynamics, fuzzy cognitive mapping, open schoolyards

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For Nora,
May our cities be better for your generation.

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1. INTRODUCTION

1. INTRODUCTION

Children are sometimes called the ‘canaries in the mines’ (Malone, 2006, p. 29), an ‘indicator species’ for the rest of humanity (attributed to Enrique Peñalosa, in Gill, 2021, p. 7). But children deserve a healthy environment not merely for the well-being of adults, but for their own health and happiness. Children’s right to development, play and more are protected in the UN Convention on the Rights of the Child (United Nations, 1989, art. 2). Protecting these rights requires a thorough consideration of the built environment in addition to the social fabrics.

Schoolyards, much like other play spaces, are one such environment that necessitates further consideration. While these spaces might not seem of significant importance, schoolyards are a crucial part of the school, itself one of the main four environments of a child’s socialisation (De Backer, 2017). Being a space that allows for more social interaction and physical activity than the rest of the school, it should not be neglected. This is especially important when considering that the mental health of Dutch children has declined since the Covid-19 pandemic, particularly amongst girls (de Lange & Braakhekke, 2023). While the declining mental health is likely a result of a complex interplay of factors, the school environment could play a crucial role. In one UNICEF report, children who felt a higher sense of belonging at school, were found to have a higher life satisfaction rate (Gromada et al., 2020). The school environment goes beyond the classroom, with the schoolyard being an important social and physical space for pupils. This requires carefully considered design and use of the schoolyard.

Schoolyards are thus an important space, but they have frequently been neglected or have fallen victim to concerns from adults. While it is entirely natural for parents to be concerned for the well-being of their child, hyper-protective discourse has potentially become too dominant in countries like the Netherlands (Jack, 2010). This discourse and the increasingly ‘safe’ designs of play spaces play one role in schoolyards becoming less attractive to children.

Creating more attractive schoolyards could make a positive contribution to the daily lives of many children, but this needs to be done carefully. Despite a shift towards increased participation of children, much of the power remains with the adults, even when designing children’s spaces (Gill, 2021). To design an inviting play space, the children themselves need to be included. This thesis aims to voice the opinions of children, with a focus on green elements and the openness of the schoolyard. These elements were highlighted due to growing interest amongst professionals, both in research and policy domains (Gill, 2021). The understanding of how children

themselves feel about these elements is notably underdeveloped. While only thirty-five children were interviewed, this nonetheless represents an important step towards their further inclusion.

The research questions are as follows:

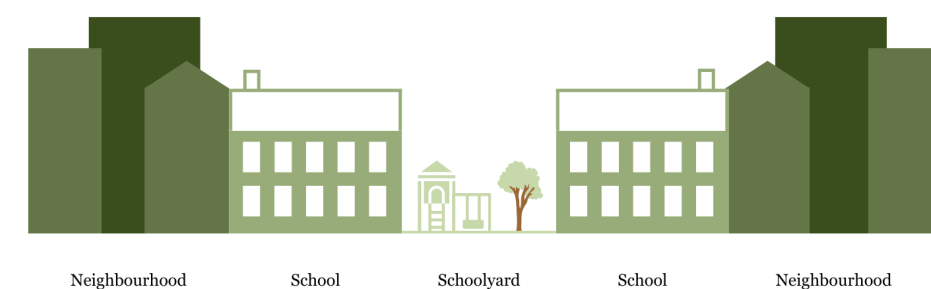
- **How do children perceive the design of their schoolyards?**
- What is the design of these schoolyards?
- How are these perceptions gendered?
- Does the openness of a schoolyard impact the children’s perceptions?

This thesis aims to answer these questions using fuzzy cognitive mapping as a methodology. Thirty-five children were interviewed, from two different schools in Rotterdam. The schools have contrasting designs, with one being green and physically enclosed, with the other being predominantly concrete and physically open.

The thesis is structured in the following manner: Chapter 2 explores the existing literature and provides the theoretical framework that allows for the interpreting of the collected data. Chapter 3 includes a more detailed description of the two schoolyards, as well as the surrounding neighbourhoods and the city of Rotterdam. This is followed by the research design and the methodology, described in Chapter 4. The results are presented following a comparison between the two schools and a comparison between boys and girls, in Chapter 5. Chapter 6 reflects on these results in relation to the literature explored in the second chapter. Finally, Chapter 7 concludes this thesis by answering the research questions and a brief reflection. The chapters are split up according to three scales, namely the schoolyard, the school and the neighbourhood, as depicted in Figure 1. This multi-scalar approach allows for a more complete understanding of children’s perceptions, allowing for more accurate research and recommendations.

Figure 1

Abstract depiction of the multi-scalar approach adopted in this thesis.



2. STATE OF THE ART

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To successfully explore children’s perceptions of their schoolyard, the existing literature needs to be reviewed. Such a review aids in discerning key elements and potential directions for the research. This chapter begins by clarifying the definition and importance of outdoor play, as well as examining the current decline of outdoor play. The following section is then split into two parts: the first contextualises outdoor play, and the second conceptualises the research context for this thesis. The first section explores the context of outdoor play using a multiscalar approach, focusing on: the schoolyard, the school and the neighbourhood. The conceptual section introduces the theoretical framework through which the research questions are interpreted.

2.1 Clarifying outdoor play

Definition of outdoor play

For many people, the concept of outdoor play evokes immediate associations. However, these associations can differ strongly; hence, clarification of the definition is needed here. Although any type of play taking place outdoors could be considered outdoor play, the focus here is more specific. It is defined here as an ‘unstructured physical activity that occurs outdoors in the child’s free time’ (Veitch et al., 2006, p. 383). This definition was chosen as it comprises both the physical activity element and the unstructured nature of play. Using a definition that encompasses both elements is key to ensuring the benefits elaborated on below. Regarding the child’s free time, it is chosen here to include breaks during the school day, as the focus of this thesis is on schoolyards.

Benefits

This type of play has significant benefits, often crucial to a child’s healthy development. The benefits are explored in further detail according to the following categories: physical, mental, and social.

Outdoor play is often associated with physical activity, such as running or football, with the associated physical benefits. In a position statement published by a group of stakeholders in the field (Tremblay et al., 2015), the benefits mentioned include improved blood pressure, a lower risk of chronic diseases, and enhanced motor skills. Many other studies have found similar benefits, although the details and extent of these benefits vary per study (e.g., McCurdy et al., 2010; Tandon et al., 2012; Godbey et al., 2009). While Wijtzes et al. (2014) found that participation in structured sports activities may have a larger impact on a child’s physical well-being than unstructured

outdoor play, unstructured outdoor play has numerous other benefits that may not be as prominent in structured sports. Unstructured play means the child has more agency, thus encouraging their independence and creativity (Barreiro & Howard, 2017).

Furthermore, these structured activities are often not accessible to children in low-income families. Such a lack of accessibility is especially concerning as children living in deprived areas are most likely to be dangerously overweight (Gill, 2021). In contrast, public play spaces do not have the same economic barriers as organised sports. While being in public space does not guarantee that children interact with children from different socio-economic backgrounds, it is much more likely to happen than in a private space. Therefore, focusing on outdoor play as an arena to improve public health remains important (Gray et al., 2015).

The physical benefits of outdoor play are even more extensive when children are given the opportunity to partake in risky play (Brussoni et al., 2015). Risky play is defined here as ‘thrilling and exciting forms of play that involve a risk of physical injury’ (Sandseter & Kennair, 2011, p. 258). It can involve heights, speed, harmful tools, dangerous elements, rough play or a situation where one can get lost (Sandseter, 2007). Whereas a more protective discourse was long dominant in many Western countries (Jack, 2010), there is a growing call amongst professionals to reintroduce a certain level of risk (Bundy et al., 2009). As risk is a fundamental part of life, it is key for children to understand it, learn their boundaries and find coping mechanisms (Brussoni et al., 2012). The playground can be an early learning place for them, with consciously designed risky environments encouraging children to assess the level of risk they feel comfortable with and act accordingly (Bourke & Sargisson, 2014). However, this gradual acceptance of risk amongst professionals has not yet been adopted by broader society, with risk remaining a predominantly negative factor in popular discourse (Bundy et al., 2009). Moreover, concerns regarding risky play differ between countries (Sandseter et al., 2020), with parents in the Netherlands being quite risk-averse (Visser et al., 2024).

Risky play can also encourage children to partake in more outdoor play. Many children tend to use their environment in a riskier way than intended and find it more interesting to do so (Brussoni et al., 2012; Sandseter, 2009). By actively designing an environment that allows for some level of risky play, potentially harmful situations can be more limited than in traditional playgrounds (Bourke & Sargisson, 2014). ‘Keeping children safe involves letting them take and manage

risks', which requires a careful consideration of schoolyard design (Brussoni et al., 2012, p. 3140). Designing an environment suitable for risky outdoor play could be done through a risk-benefit assessment, which is growing in popularity in the United Kingdom (Gill, 2021). This type of environment could thus attract more children and play a more significant role in their development. A significant body of literature has shown that children enjoy engaging in risky play, making it more likely for them to continue playing outdoors (Gray, 2020; Brussoni et al., 2012). Furthermore, children are likely to improve their risk-assessment strategies when they can engage in risky play, with school environments being a suitable place to offer these learning opportunities (Lavrysen et al., 2017).

Although playing outdoors can involve a child playing alone, it is common for the child to encounter peers or actively meet their friends to play together. These encounters are a key part of the importance of outdoor play and provide opportunities for children from different backgrounds to interact (Yogman et al., 2018). Karsten and van Vliet argue that 'outdoor play is essentially social play' (2006). This socialisation can contribute positively to their emotional well-being (Merewether, 2015; Sturges et al., 2023; Yogman et al., 2018) and sense of belonging (Rogers, 2012). Public space is considered one of the four environments of socialisation, along with the home, school and free time. It has long been a key place for children to be socialised (Rogers, 2012). Besides the ease of access, public spaces allow children and older youth to have a space of their own, outside of school and home environments (De Backer, 2017). It is thus crucial not only in providing a physical space, but also in providing opportunity and allowing children to socialise according to their own preferences. Spending time in public space can also strengthen a child's connection to their neighbourhood and their sense of place (De Backer, 2017).

Moreover, research has found that the mental health of children benefits from outdoor play. Their self-reported mental well-being improves if they play outside more, as compared to an equal amount of screen time (Janssen, 2016). Additionally, there is evidence that outdoor play can increase skills such as self-regulation and conflict resolution (Tremblay et al., 2015). Engemann and colleagues (2019) found a strong positive association between green spaces and improved mental health, including those near schoolyards. While it is not possible to achieve a complete picture of outdoor play and its benefits, it is evident that outdoor play is crucial for children's healthy development, including physical, mental and social well-being. Overall, these positive effects could also interact; for example, more social interaction could explain some of the improvements in mental health.

Current situation

A worrying decline in the time that children spend playing outdoors has been observed (Tremblay et al., 2022). Although this might be a more prominent phenomenon in highly urbanised countries (Hart, 2002; ARUP, 2017), a global trend of this decline can be discerned (Singer et al., 2009; Shaw et al., 2015). The underlying causes of this decline in outdoor play are highly context-dependent and complex. Below are some recent developments that may be potential factors in this decline.

Parents often act as gatekeepers, influencing their children's mobility and activities (Frank & Van Loon, 2011). They can do this by setting rules, by modelling behaviour through their own choices and how they voice their opinions. If the parental attitudes change, they might set different rules or change their own behaviour, which could carry on to the children's behaviour. Several studies have shown that parents are increasingly concerned about their children's well-being, which likely impacts their children's mobility (Cox et al., 2024; Brussoni et al., 2018; Little, 2013). These concerns are extensive, but two dominant strands of concern can be identified in the existing literature.

The first of these worries concerns social safety issues, with parents warning their children about 'stranger danger' (Brussoni et al., 2012). While these fears, especially those of abduction, are usually not supported by the corresponding statistics, parents nonetheless limit their children's mobility as a result of this fear, thus reducing a child's opportunity to play outdoors (Gill, 2021). Another major parental concern is related to traffic, one of the leading causes of death for children around the world (Gill, 2021). Although more prevalent in low- and middle-income countries, the issue is also relevant in high-income countries, such as the Netherlands (SWOV, 2019). It is not just the risk of car accidents that poses a threat to children's well-being, but also the associated air pollution. While pollution is not recognised as a threat to the same degree, it still poses significant dangers to a child's health (Gill, 2021).

Parents thus have numerous reasons why their children are safer indoors, where they can be supervised and protected. Furthermore, Larson et al. (2019) found that increased screen time might be a key factor in the decline of outdoor playtime. Spending a significant amount of time behind a screen is associated with substantial adverse effects on both physical and mental health (Hinkley et al., 2018; Janssen, 2016). This increased screen time is often modelled by the parents, part of a larger lifestyle shift away from outdoor entertainment (Lee et al., 2021).

Often overlooked, however, is the decreased attractiveness of playgrounds as a potential explanation. For playgrounds to be an interesting alternative to phones and computers, they must be designed with children in mind. Instead, the dominant protective discourse (Jack, 2010) has led to playgrounds that do not interest children for extended periods (Zamani, 2016). These playgrounds no longer present an inviting alternative to children, with the risk and thus excitement having been designed out.

The decline in outdoor play is not geographically neutral, with the factors described above and others being heavily context dependent. Having a clear image of the state of play on a global scale is complicated, with a range of challenges, including definitional issues, varying priorities, and different urban fabrics. In many situations, it is not possible for playgrounds to be a priority (Pascoe, 2017). Even when some resources are available for play spaces, they will vary significantly depending on the context. Because of this diversity, statistics for the Netherlands will be provided here, in line with the scope of this research.

In the Netherlands, 32% of children aged 6 to 12 years old were found to rarely or never play outside, an increase from 20% in 2022 (Jantje Beton, 2024). On average, they also spend less time playing outside than two years ago, and fewer children are allowed to play outside without adult supervision. Nonetheless, most of the children surveyed still enjoyed playing outside, and their parents understood the importance of it for their children’s development. The parents discussed several concerns, largely similar to those found internationally, including digital entertainment, a lack of play spaces and playmates, and concerns about physical and social safety. One that might be more context-specific was the weather-related concerns, brought up by more than half of the surveyed parents.

2.2 Contextualising outdoor play

As previously explained, this thesis is structured along the scales of the schoolyard, the school and the neighbourhood.

The schoolyard

Much of the research on children’s play spaces concerns playgrounds, rather than schoolyards. Literature from both types of play spaces will be explored here to achieve a comprehensive notion of the existing research. First, the wider concept of play space will be introduced, followed by an examination of schoolyards and a closer look at green schoolyards. This is complemented by a section on gender dynamics within play spaces.

Woolley and Lowe write that play space is a ‘transferable and loose notion that can be applied to any environment in which a child chooses to play’ (2013, p. 54). The focus here is on formal play spaces, defined by them as ‘outdoor environments that have been specifically designed and designated as a place in which children can play’ (Woolley & Lowe, 2013, p. 54). A typical example of a formal play space is a playground with fixed equipment made of synthetic materials in bright colours. However, these playgrounds can look entirely different, although they usually consist of fixed equipment.

It should be noted that both formal and informal play spaces have a role in a child-friendly city, with each having its own set of benefits and challenges. Formal play spaces, specifically playgrounds, are a recent phenomenon. These spaces were meant to address two issues: increasing traffic and the dangers of street life. Children were removed from the street to distance them from these issues (Gill, 2021). While this is no longer the only motivation behind play spaces, their origins likely still influence the design to this day. Furthermore, Pascoe argues that playgrounds are not neutral spaces, but that they ‘reflect prevailing cultural concepts’ (p. 10, 2017). It is necessary to consider both the history and the wider cultural context when researching play spaces.

The play spaces discussed here belong to a particular subcategory: schoolyards. Although this might seem minor, it can be a different world for children and make a world of difference for them. Reimers and colleagues (2018) emphasise that a child is likely to behave differently on a school ground than in a public park or playground. This difference in behaviours is partially due to the mandatory nature of the schoolyard but is also related to the different contexts. Children might consider it more of a private playground, with teachers providing access to the pupils but not to anyone else (Karsten, 2003), which increases the feeling of safety. Many studies explore behaviour on school grounds, providing a significant body of knowledge that will be delved into here.

Schoolyards are not monoliths, reflecting their cultural and social context, as well as the planning doctrine. This large diversity in schoolyard design is not limited to the available affordances but extends to their openness to the public. Some are much more similar to public playgrounds in their degree of access, having no or limited fences, while others are entirely closed off. Other schoolyards choose to be open to the public after school hours, or until sunset, while the yard is closed off during school hours. In Rotterdam, schools are encouraged to make their

schoolyards publicly accessible outside school hours, making it a more public space. This increased accessibility allows them to function as playgrounds for the wider neighbourhood (Gill, 2021). Schoolyards that receive municipal funding are encouraged to open their schoolyards and interact with neighbours, creating a ‘green living room’ (Groen-blauwe Schoolpleinen, n.d.). This shift towards open schoolyards is not limited to Rotterdam but is also gaining popularity in other contexts (Bates et al., 2018; Sekulova & Ruíz Mallén, 2023). As this increased openness is a recent phenomenon, it presents an interesting avenue for further research. This is reflected upon further in the section on the neighbourhood scale.

The school a child attends usually plays a significant role in their life, as it is one of the places they visit most often. Although not all pupils in the Netherlands live near their school, the majority do, with the government aiming to have a public school within a ten-kilometre radius of every child (Onderwijsraad, 2019). Even those who live further away attend school daily, thus interacting daily with the schoolyard, its surroundings and the route from home. Moreover, enhancing a neighbourhood’s infrastructure and facilities can benefit children from low-income families significantly. Such changes can encourage physical activity near the home, either as active transport or outdoor play, which are low-cost endeavours (Nicksic et al., 2018). Furthermore, children spend a significant part of their days at school, making it a key area in their development. This development entails more than just academic progress; it includes social and physical growth (Zhang et al., 2022).

Natural play spaces

The term natural (also referred to as green) schoolyard is rather broad, capturing a wide diversity of schoolyard designs. For instance, a natural schoolyard can focus mainly on water elements or prioritise a variety of green spaces. Most combine various factors, including water, sand, and greenery (Stevenson et al., 2020). Planting a tree in a predominantly concrete schoolyard is insufficient; a natural schoolyard not only requires a wider variety of elements but also a larger understanding of children’s development. A green schoolyard should provide an environment where children can interact with nature, reduce their stress and be protected from climate stress (van den Bogerd & Maas, 2024).

While the distinction, described above, between schoolyard and public playground should be made here, the existing research is still limited, so studies concerning either are referenced here. Naturally, this type of play space is far from new and, in a way, a return to previous iterations of play spaces. More natural play spaces have

mainly been replaced by ‘safer’ and easier-to-maintain playgrounds made of plastic or metal, with most of the risky possibilities removed by design.

Both the interest in these natural play spaces and the number of such spaces constructed have increased. Prior studies have attributed a range of benefits to this type of space, which are different or more substantial than those in traditional playgrounds. These spaces provide more and different opportunities to play, as they are more open-ended than the mono-functional metal play structures (Fjørtoft, 2004). Open-ended play can be encouraged by having loose natural materials, where no clear goal has been assigned and children can be more creative in their play. Children seem to improve their motor skills and coordination (Fjørtoft, 2004). A concern about this type of play space is the additional effort required from parents or teachers, such as providing supervision or washing dirty clothes (Van Dijk-Wesseliuss et al., 2021).

Surprisingly, these natural play spaces encourage more gender-mixed play and more behaviour outside of the gender-stereotyped ones (Karsten, 2003). Many researchers have found a difference between the activity levels of boys and girls on more traditional playgrounds, with boys being more physically active on the school grounds (Blatchford et al., 2003; O’Connor, 2017; Gill, 2021), potentially due to the availability of many non-gendered activities. Less gendered activities are games such as tag and hide-and-seek, which are more easily facilitated in natural play areas. The prevalence of those activities could be an underlying reason why boys are more likely to have female playmates in such environments (Karsten, 2003; Änggård, 2011). Additionally, some girls associate traditional playgrounds with a formal competition, and they feel less welcome when they do not want to participate (Nicksic et al., 2018). Thus, changing a playground could increase the number of children who play outside by expanding the scope of play and reducing existing differences in participation.

Natural schoolyards face a variety of critiques, including the dangers and extra effort required. However, a growing body of professionals is recognising that children’s needs deserve to be prioritised above adults’ convenience, whether in reintroducing sand pits or increasing the number of community gardens (Hart, 2002; Lee et al., 2021). Moreover, traditional playgrounds do little to mitigate the effects of climate change, such as the lack of permeable ground and high levels of concrete. These spaces are no longer comfortable to play in during summers; green schoolyards with more trees, shade and water could be a way to counter some of this (Raney et al., 2023).

Gender

As briefly mentioned in the section on green schoolyards, gender dynamics play a role on the playground and in the schoolyard. While feminist urbanism is explored further in the conceptual section, it is necessary to understand that girls face a range of more specific issues in the built environment and the city as a whole, and on playgrounds and schoolyards. Moreover, the gender norms associated with these play spaces also impact boys negatively. The marginalisation of girls and certain boys is often spatialised, with these children being pushed to the edges of the playgrounds (Paechter & Clarke, 2007; Karsten, 2003; Pawlowski et al., 2019). Besides being more likely to dominate the play spaces, boys are frequently given more freedom and independent mobility at a younger age (Prezza et al., 2001). The same study found that the children with higher independent mobility were the children with more social interaction, crucial for their development. Girls have also been found to prefer more spacious schoolyards (Snow et al., 2019).

The gender dynamics within the schoolyard extend beyond physical marginalisation, but actively impact the activities that children tend to participate in. A significant body of literature has shown that girls tend to prefer less competitive activities, favouring balancing and coordination activities and imaginary play (Pawlowski et al., 2019; Reimers et al., 2018). Moreover, some girls prefer to sit and chat on manufactured equipment, rather than engaging in active play (Bourke & Sargisson, 2014). On the other hand, boys were more likely to engage in sports activities, such as football and basketball, as well as partake in activities on manufactured equipment (Reimers et al., 2018; Barenie et al., 2024). Boys have also been found to prefer concrete surfaces, dominating this type of environment more so than grass or other environments (Bourke & Sargisson, 2014). Swings were popular amongst boys and girls, being an activity that is not as gendered (Barenie et al., 2024; Bourke & Sargisson, 2014). This popularity applies especially to the typical swings, with a basket swing being preferred by girls (Bourke & Sargisson, 2014). Similarly, boys and girls participate in climbing and spinning (on swings or other equipment) at similar rates (Raney et al., 2023; Sandseter et al., 2021).

Some children engage in behaviour different from what gender roles prescribe or cross-gender behaviours, sometimes resulting in exclusion on the playground (Thorne, 1993). Boys engaging in such behaviour are likely to face judgement from their parents, while girls seem more excluded from ‘male’ activities by their peers (Freeman, 2007; Boyle et al., 2003). Furthermore, boys are less likely to engage in cross-gender activities (Karsten, 2003). It thus highlights that although boys often

have more power in determining what happens in the playground, both in the space and time they occupy, they too are negatively affected by the gendering of these activities.

‘Gendered activities have a strong spatial dimension’ (Karsten, 2003, p. 466), which is why it is important to understand the differences in play by gender. Paechter and Clarke (2007) elaborate on this argument, highlighting that these spatialised gendered activities further complicate the ability for cross-gendered behaviour. Isci and Hasirci argue that ‘gender norms mean that girls and boys develop different risk-taking strategies’ (2023, p. 47), potentially due to the gendering of these activities. Additionally, Karsten (2003) argues that physical boundaries can be akin to gendered boundaries and that physical aspects of a play space can strengthen gender stereotypes. However, not all studies find similar results; Reimers and colleagues (2018) found no difference in physical activity between boys and girls, although they did note that the activities favoured were different between the two groups. This discrepancy highlights the need for further research.

The school

The school plays a key role in the schoolyard, with its role extending beyond the design of the space and including maintenance, supervision and education about the schoolyard. The previous section has already highlighted the importance of the school, being one of the four key environments in someone’s youth (De Backer, 2017). Teachers can encourage or discourage certain behaviours, whether intentionally or unintentionally. They could take the initiative to play a new game or organise a different activity (Lundy & Trawick-Smith, 2021; Clevenger et al., 2021). A teacher’s beliefs concerning risky play can also impact the pupils’ attitudes towards this, either encouraging or discouraging it (Little et al., 2011).

Schoolyard regulations can differ strongly from each other, with some schools not allowing children to climb in trees and leave the schoolyard, where others encourage the children to think carefully themselves. Aminpour and colleagues (2020) found that it was mostly boys choosing to ignore the rules, spending their time playing in out-of-bounds areas. This created an unequal access to play spaces, leaving girls to play in less interesting and more crowded areas. As the schoolyard rules can vary so significantly, this will not be explored further but should be noted.

Maintenance of schoolyards is important in upholding safety standards, as well as the continued interest in these spaces (Sekulova & Ruíz Mallén, 2023). While the

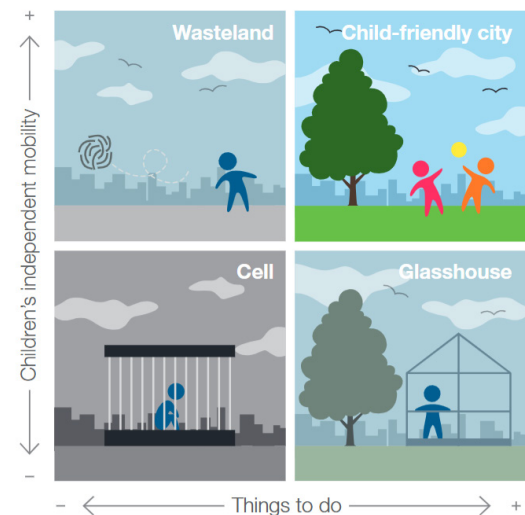
responsibilities for maintenance differ per context, the school often plays a key role. Even if regular maintenance is not inside their responsibilities, they are likely motivated to uphold maintenance, for the safety of their pupils (Sekulova & Ruíz Mallén, 2023). Rigolon et al. (2015) found that it was essential to include children in the maintenance of their schoolyard, strengthening their relationship with nature and their schoolyard.

Lastly, the schoolyard can also be a space for children to learn and engage with their environment in a unique way. Outdoor learning has been found to provide a range of benefits, including increasing knowledge about nature and being calming for pupils with learning difficulties (van Dijk-Wesselius et al., 2020). Such outdoor learning could be teaching more traditional subjects, such as mathematics or spelling, outside, or it could be natural education, encouraging children to engage with the natural elements of their schoolyard. This educational practice could thus be significantly beneficial for many children.

The neighbourhood

Public space and specifically a child’s direct surroundings play an important role in their youth, although our understanding of this role has changed significantly over the past century. Children are increasingly recognised as active users of space with their own needs and opinions, a shift that started in the 1970s (Warren, 2020). Since the 1990s, child-friendly urbanism has gained popularity, with scholars like Roger Hart and organisations such as UNICEF devoting significant efforts to it. Nonetheless, children’s inclusion in design and active participation remained limited (Gill, 2021). Gill argues that child-friendly urbanism has been gaining popularity recently. This new wave has seen the engagement of other actors, including municipalities and non-governmental organisations. This increase is slowly starting to translate into changes in the urban environment. However, this progress is highly context-dependent, varying not only on a national level but even per neighbourhood.

Figure 2
Conceptual model of child-friendly urban planning (ARUP, 2017, based on Kyttä, 2004).



Child-friendly urban planning ‘sets out the basic case for cities to be good, healthy places for children to live, play and grow up’ (Gill, 2021, p.26). It recognises children’s rights in both current and future situations. In a conceptual model by Kyttä (2004), shown above, two dimensions are considered structuring variables for child-friendly urban planning: the level of independent mobility and the number of actualised affordances. Although this mainly concerns the wider environment, it remains an important model to understand children’s needs in urban planning. The affordances provided within the schoolyard are the primary focus of this research, but the mobility aspect is briefly touched upon as well.

Van den Bogerd et al. understand affordances as ‘functional properties of the physical environment perceived by the child according to its needs and abilities’ (2023, p. 4). Relevant affordances within play spaces include opportunities for climbing, running, building and many more (Kyttä, 2002). While affordances can be provided in many ways, manufactured equipment is often relied on to do so. Having enough affordances is crucial for a schoolyard to remain interesting to children for an extended period and develop more skills (Renata et al., 2021). Green schoolyards could be exceptionally well-suited to provide various affordances, often having open-ended materials and elements as well as several topographical elements (van de Bogerd et al., 2023). These elements allow children to improve their motor skills, as well as their social and creative development. Affordances can provide ample opportunity for risky play, whether inherent to the design or afforded by the child’s own abilities. As described previously, risky play can be beneficial for a child if the environment is designed appropriately.

The framework pictured in Figure 2 (Kyttä, 2002) highlights that children’s experience of the play space is not limited to that space, but includes neighbourhood factors. This includes the route towards the play space, as well as its direct surroundings. Especially in open schoolyards, this should be taken into consideration. Limited research is available on the opening up of schoolyards, but some studies have been conducted on this topic. Reith et al. (2022, p. 3) reflected on schoolyards being ‘transitional zones or interfaces between the inside and outside where the school facility meets the city’. Several municipalities, including Rotterdam, are moving to encourage or require schoolyards to be open to the larger public (Sekulova & Ruíz Mallén, 2023). Proponents argue that opening the school space to a wider public could increase community cohesion and provide much-needed extra public space (Bates et al., 2018; Dessì, 2020). However, an open schoolyard also makes it easier to enter and exit, which raises safety concerns (Derr & Rigolon,

2016). These safety concerns can concern the presence of unfamiliar adults, as well as litter left by people outside of school hours (Van Dijk-Wesselius et al., 2021). However, limited studies exist about this, especially concerning the relation to open schoolyards. To compensate these negative consequences, some schoolyards limit this access spatially, temporally, or both.

These factors above highlight the importance of the neighbourhood when considering children’s perceptions of the schoolyard, thus requiring a perspective that can incorporate these different elements.

2.3 Conceptualising outdoor play

Existing literature, touched upon in the previous section, suggests a myriad of avenues for future research and highlights how complex the world of play spaces is. In the following section, a conceptual approach will be presented that focuses on the key elements to analyse the empirical data. This will be done according to the overarching research question, ‘How do children perceive the design of their schoolyards?’ and will be explored in the sections hereafter. Safety and quality are the central elements in this theoretical framework, which together constitute the focus of the perceptions referred to in the research question. These perceptions are understood using key factors, identified from prior research and relevant theories, which provide analytical lenses for the study. In the following section, these elements will be elaborated upon to underpin the conceptual framework.

Figure 3
Theoretical framework.



Feminist geographies

Feminist geographies aim to understand the gender perspective in geography and incorporate it into the broader body of knowledge. As feminist geographers embrace the diversity of experiences, a broad body of literature exists, and the theoretical lens can be conceptualised in many ways. In this thesis, it is understood that a ‘geographic perspective on gender offers a way of understanding how sexism functions on the ground’ (Kern, 2020, p.13). This translates into a material geography of exclusion and a society where ‘male power [is] upheld by keeping women’s movements limited and their ability to access different spaces constrained’ (Kern, 2020). Jane Darke writes that ‘our cities are patriarchy written in stone, brick, glass and concrete’ (1996, p. 88). While this statement is rather spatially deterministic, it is evident that our built environment continually impacts power relations and wider social relations. It is not only built according to specific values but also embodies and legitimises them further (Bondi, 1992; Knox & Pinch, 2014).

While many early feminist geographers lacked intersectional analysis and a more transformative vision, this has strongly improved (Moss, 2002). Using a feminist geography thus requires an intersectional approach, including a nuanced understanding of privilege. While patriarchal societies dominate women, they treat white women differently from women of colour. Unfortunately, due to the limited sample size, intersectionality cannot be studied in this thesis. Other studies were able to examine the impact of ethnicity on the playground, including Karsten (2003), Bates et al., (2018) and Zhang et al. (2021).

A feminist perspective on geography is not just epistemologically relevant, but also plays a role methodologically. Feminist geographers should carefully examine their research process, from topic to methodology and include positionality (Moss, 2002). It requires rethinking concepts such as knowledge and power, as well as the relationship between the researcher and participants (Moss, 2002). Feminist geography is not merely about looking at women’s issues; it is a different view entirely, informed by power relations in both the built environment and dominant research processes. It is used here as a guide to approach a research design that scrutinises dominant ideas in the choice of topic, methodology and data analysis.

These power relations exist in playgrounds too, with gender dynamics playing a role even from a young age. This prevalence translates into inequalities at a young age, with girls often being less physically active and nonconforming children being excluded. Due to the role of spatial environments on social relations, and the gender dynamics frequently found in play spaces, it is thus necessary to examine gender within this thesis.

Nature-based solutions

Green schoolyards are part of a much larger movement towards nature-based solutions (NBS). NBS are solutions inspired by nature, benefiting sustainability while tackling one or more issues (European Commission, n.d.). Usually cost-effective and adaptable to local contexts, more stakeholders are recognising the importance of these solutions. An example of NBS is the increasing number of floodings in urban areas, which could be mitigated by replacing concrete with soil, increasing the permeability of the ground (Baró et al., 2022). Even within schoolyards, NBS can play a positive role. Adding more green elements to schoolyards can benefit the children through various affordances, a positive health impact and climate shelter. The positive impacts of greening the schoolyards extend into benefits for the environment, including enhanced biodiversity and mitigating urban heat islands (Van de Bogerd et al., 2023).

In an earlier section, green schoolyards were explored, along with the associated benefits. Briefly, the characteristics of such a green schoolyard need to be elaborated. A nature-based schoolyard includes a challenging play and learning landscape, various green zones, natural and sustainable materials, native plants, measures to prevent flooding and heat stress, opportunities for outdoor education, support for biodiversity, and promotion of healthy food choices (Overheid.nl, n.d.). Defined in the framework as greenness for brevity, this includes the variety of elements mentioned above.

Safety perceptions

Safety is an umbrella concept for a variety of fears, including social and physical ones. Safety perceptions are the focus here, as there is often a discrepancy between perceptions and relevant statistics. People tend to base their decisions on their perceptions of safety, rather than statistics (Miles, 2008). Making children feel safer should thus include a consideration of how they perceive a situation, as they are likely to make their choices based on these perceptions. This thesis uses the broadest conceptualisation of safety perceptions to accurately reflect the participants' concerns, such as equipment or the presence of strangers.

It is considered a guiding concept here, as perceived safety is important for parents and other adults in allowing their children to play outside (Kruse et al., 2021; Jantje Beton, 2024). Moreover, their ability to act as gatekeepers significantly influences a child's outdoor play behaviour, further increasing the relevance of perceived safety for this topic (Van Loon & Frank, 2011). However, while research on children's safety perceptions exists, systematic insight is lacking (Van Loon & Frank, 2011). In this

thesis, the children themselves were asked about their safety perceptions and the factors they considered important.

Research implications

This chapter has aimed to provide a background and a framework for the research analysed and explored in the following chapters. Some potential answers to the research questions can already be identified, although this poses significant difficulty. The aim of this thesis is to focus on children's voices, which remain underrepresented in existing literature. Furthermore, the research question on openness cannot be answered from a children's perspective using existing studies, due to the limited availability of data on this specific topic.

While analytically distinct and described separately in this section, the elements above are often interconnected and influence one another. For instance, the perceived safety of a playground is partially dependent on the affordances provided, while the gender dynamics influence these safety perceptions and the level of gatekeeping (Frank & Van Loon, 2011). In the following chapters, these elements are understood to be related, even when mentioned separately.

- **How do children perceive the design of their schoolyards?**

Despite a shift towards the inclusion of children in research, it seems like a large number of studies still use observation to assess children's enjoyment of their play spaces. These studies indicate that children enjoy risky play and are more likely to engage in physical activity in green schoolyards, with less conflict arising in such spaces.

- What is the design of these schoolyards?

It is evident that schoolyards are diverse spaces and their design varies strongly, influenced by cultural and social context. Nonetheless, a shift can be identified towards green schoolyards, and there is growing advocacy for these schoolyards to accommodate more risky play.

- How are these perceptions gendered?

The described literature indicates that certain gender dynamics are often present in play spaces and specifically schoolyards, with activities being perceived as for one gender only. Furthermore, the children who do not adhere to these gender expectations might be ostracised. Green schoolyards could be an important avenue to mitigate this, due to the limited gender expectations on the types of play common in these schoolyards.

The research implications of this theoretical framework thus include several gaps within existing research, particularly concerning children’s perspectives and the opening up of schoolyards. Moreover, some studies have pointed out that green schoolyards raise additional concerns amongst parents but rarely discuss the children’s experiences. This thesis aims to contribute knowledge to these research gaps, while considering the gender dynamics frequent and socio-spatial contexts of these schoolyards.

3. CASE STUDY

3. CASE STUDY

This chapter introduces the broader context of this research and the specific case study schoolyards. It introduces the city of Rotterdam, as well as the neighbourhoods of the Provenierswijk and Spangen, followed by a description of the specific schools. The focus in these descriptions is mainly on information relevant to the research question, such as children’s habits and the built environment.

The municipality of Rotterdam counted more than 670,000 inhabitants in 2024 (Onderzoek010, n.d.-a) and is the second-largest city in the Netherlands. A combination of factors, including the devastating bombings in 1940 and the following reconstruction have meant that Rotterdam is often categorised as an ‘un-Dutch’ city, especially in comparison to Amsterdam. Amsterdam’s canals and bikes starkly contrast with Rotterdam’s high-rise buildings and car-oriented streets. While the level of car dependency in Rotterdam is not drastically different from that of Utrecht (Onderzoek010, n.d.-d), the city feels much more car-dominated. Cycling is a less popular choice amongst Rotterdam’s inhabitants, contributing to what feels like a stark contrast between Rotterdam and other major Dutch cities.

This contrast between Rotterdam and Amsterdam is not limited to the built environment but extends to its social fabric. A former mayor of Rotterdam described the city as ‘leading the wrong lists’, having the cheapest housing stock, the highest unemployment rates and a variety of other issues (de Lange, 2000). While this description does not do justice to the complexities of Rotterdam and its residents, it is emblematic of a narrative that has long been dominant surrounding the city (Engbersen et al., 2019).

In recent years, efforts have increased to amend some of these issues. Additionally, more efforts are being dedicated to greening Rotterdam, as the city scores relatively poorly regarding green spaces. In the city’s Green Agenda for 2023-2026, a variety of interventions are proposed to increase the greenness throughout the city (Gemeente Rotterdam, 2023). One such intervention is funding green-blue schoolyards, which provides subsidies for elementary schools that want to make their space more climate-adaptable. This funding aims to increase the amount of green space in Rotterdam and the quality of the schoolyards for children. Specifically, the funding body describes green schoolyards as places where children can be children, develop a wide range of skills, and find calm during a busy school day. These benefits are described to extend to the teachers, parents and animals (Groenblauwe schoolpleinen, n.d) and foreseen to be particularly powerful, as the aim is to open the schoolyards to the broader community outside school hours. So far, eighteen schools

have transformed their schoolyards using this funding, and every year, five more schools receive this funding (Groenblauwe schoolpleinen, n.d.).

These projects fit within a wider move towards greening within Rotterdam and a larger agenda to make the city more child-friendly. Having previously been ranked the worst city in the Netherlands to raise a child, it has since significantly improved (Gill, 2021). Through several phases of interventions, the city has renewed its playgrounds, schoolyards and the wider public space (Van den Bosch & Donkers, 2021). While adapting a city to be more child-friendly often has significant positive impacts, these types of urban interventions should not be seen as apolitical.

The many benefits associated with (green) play spaces are plentiful, and this explains why this narrative of a good city for children being a good city for all is dominant. Moreover, these benefits could be especially important for children living in disadvantaged neighbourhoods (Formoso et al., 2010). Furthermore, Oscilowicz et al. (2020) found that early gentrification processes could initially benefit the original families, with green play spaces encouraging more social interactions between residents.

Likely a cause and a consequence of the shift towards child-friendly urbanism, Dutch families are increasingly likely to stay in the city after having children (Karsten, 2003; Booi et al., 2021). While at lower rates than in Amsterdam and Utrecht, higher-income families within Rotterdam have also returned to the city or stayed after having children (Booi et al., 2021). With this return to the city becoming increasingly popular, there is a higher risk of displacement for the existing city-dwellers (Booi et al., 2021). The consequences of these displacements could be detrimental for children who already lived in the city, complicating the idea of child-friendly urban renewal further. These children will not benefit from the interventions if their families can no longer live nearby. Furthermore, they will be affected more negatively, as being displaced likely will disrupt their social networks.

While several other Dutch municipalities have adapted their cities in favour of children, Rotterdam was both early and rigorous in its child-friendly urbanism (Koning, 2012). Local authorities highlighted the necessity for these policies using reasoning that was not dissimilar to the one described above. Rotterdam was once considered as the worst city in the Netherlands to raise children, spurring the municipality to take action. By adapting the city to be more child-friendly, the authorities also aimed to retain and attract more middle- and high-income

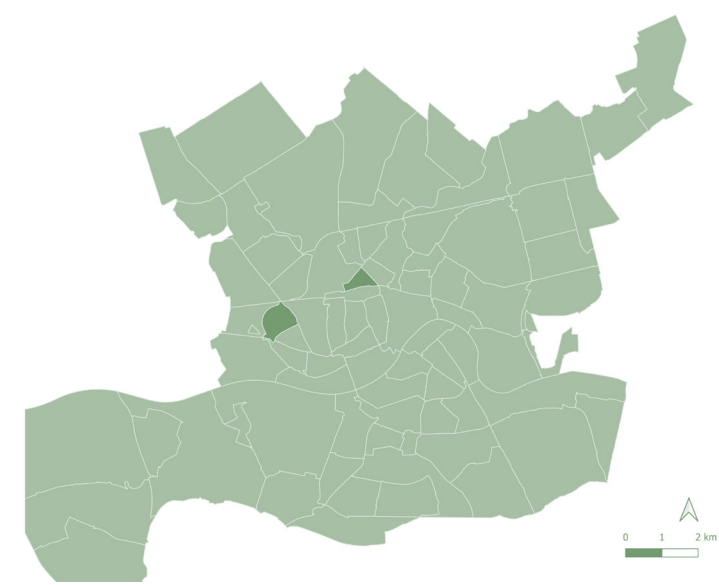
families, to further their vision for the city (Rotterdamse Rekenkamer, 2012). These adaptations are not neutral, nor spread equally. Previous studies have shown that green schoolyards are often located in wealthier areas, limiting the benefits to children in these neighbourhoods (Gallez et al., 2024; Baró et al., 2021).

A nuanced understanding of these dynamics, reflecting both the benefits and the costs and the impacted groups, is necessary when researching the impacts of these spaces as it provides crucial context in these processes.

3.1 Research neighbourhoods

During the research process, forty-three schools were reached out to via phone and email. Four schools responded affirmatively, and data was collected at all four. Within this thesis, the focus is on two out of these four. The chosen schools had the highest number of participants and provided an interesting contrast to each other. The first school is located in the Provenierswijk, where data was collected in December 2024 and January 2025, for a total of two days. The second school is located in Spangen, and data was collected for two days in January 2025. The following statistics were retrieved from the Rotterdam statistics dashboard, unless otherwise indicated (Onderzoek010, n.d.-a, n.d.-b, n.d.-c, n.d.-e).

Figure 4
The neighbourhoods of Rotterdam, with two highlighted: '1' indicating the Provenierswijk, and '2' the district of Spangen.



The Provenierswijk is located near Rotterdam’s central station and has some 4500 inhabitants. Compared to the citywide average, there is a similar proportion of Dutch inhabitants to non-European Union origin inhabitants, around 45%. Moreover, the Provenierswijk’s income distribution is in line with the city average, with nearly 70% of inhabitants having a high income, 22.4% a medium income and 8.2% a low income. Only 12.7% of residents are under 18, compared to the city’s average of 18.1%. In the wider area around the Provenierswijk, high schools are largely theoretically focused, much more than the city average. These statistics could be an indication of unequal educational access, which would further existing inequalities (Nederlands Jeugdinstituut, 2020). Lastly, 70.8% of children in the Provenierswijk join organised sports at least once a week, and 80% of the children are at a healthy weight.

Spangen is in the western part of Rotterdam with around 10,000 inhabitants. Only 18.7% of the residents are of Dutch origin, one of the lowest percentages in Rotterdam. 69.5% of residents are not of European origin, with especially a large group of people from Moroccan and Turkish origin. Compared to the Rotterdam total, the income in Spangen is slightly lower: slightly more than half of the population has a high income, a third has a medium income, and 12% is low income. 22.3% of Spangen residents are under 18 and 14.4% of households are one-parent families. The high schools around Spangen largely offer practical education, more in line with the Rotterdam average. In Spangen, half of the children exercise weekly in an organised manner, and 70.2% are at a healthy weight.

While these statistics help us understand these neighbourhoods, they only provide one part of the story. They show that the neighbourhoods compared are different, despite their geographical proximity. This is further confirmed by the narratives about these neighbourhoods. Spangen is described as a neighbourhood with a ‘rough past’, which is now gaining popularity thanks to a range of socio-spatial developments (Wijkprofiel Rotterdam, n.d.-b). This rough past refers to the eighties and nineties, when Spangen was known for its popularity amongst drug dealers and users. It was only in the late nineties that local authorities and residents were able to enforce interventions, significantly changing the neighbourhood. As described by a long-time resident of Spangen, ‘they [other residents] now call me to tell me that a pavement tile is crooked’ (Verdoold, 2020; as cited in Tap, 2020). While Spangen still faces some issues and territorial stigmatisation, this resident’s view highlights that it has changed significantly in the last thirty years.

The Provenierswijk, on the other hand, is described by its historic buildings, its dedicated resident organisation and its attractive facilities. It is an older neighbourhood, with relatively high-quality housing stock and a central location. While Spangen is known for its rough history, the Provenierswijk is described as a calm and green neighbourhood (Wijkprofiel Rotterdam, n.d.-a; Schutte, 2023). The different socio-spatial contexts cannot be ignored within this research, as they likely play a key role in the daily lives of their residents. This will be reflected upon further in the following chapters.

3.2 The schools and schoolyards

Due to privacy concerns, the names of the schools are not shared. However, a short description is provided of each school and especially their schoolyard to contextualise the research. The schools will be referred to further on as School 1 or the Provenierswijk school and School 2 or the Spangen school. While both schools are formally Roman-Catholic schools, they embrace multiculturalism and have a diverse body of staff and students. Moreover, both schools are part of an initiative that aims to foster a healthy learning environment by encouraging healthy nutrition and exercise for the students. Finally, while both schools have an inner schoolyard, these are spaces meant for the youngest children, and it is thus excluded from this analysis.

School 1 has less than 300 students and a schoolyard measuring roughly 650m². The schoolyard is enclosed but is often opened after school hours, with staff organising some activities. The schoolyard has been recently renovated, using the previously mentioned green-blue subsidies, and has a significant number of affordances. There is climbing equipment, a climbing wall, a corner with open-ended building materials and more. These objects are mainly made out of natural objects, and most of the schoolyard is rather green. There is also a staff member who is both the gardener and an educator and teaches the students weekly about caring for nature and animals. Lastly, a football field is no longer located in the schoolyard, but the staff take the students to a nearby pitch once a week.

School 2 has roughly 150 pupils, but the schoolyard is much larger, around 3000m², with no fences surrounding it. It is thus accessible to everyone and children could freely leave the play space. The schoolyard is much larger, but it is quite empty, resembling a public square with playground equipment added as an afterthought. There is one large wooden climbing structure, some metal climbing racks and a small slide. Additionally, there is a football field with artificial grass. Previously, there were

swings and a table tennis table, but those were removed due to safety concerns and noise complaints from the neighbours. These complaints were mainly related to teenagers and adults' use of these facilities at night. Currently, there are few natural elements, with most of the schoolyard being covered in tiles or artificial grass. The school plans to renovate the schoolyard, supported partially by the same green-blue subsidies.

The two schools are again rather different, in terms of size, affordances and openness. It is for these differences that the schools were chosen, as they could potentially provide new insights on urban schoolyards.

4. RESEARCH DESIGN

4. RESEARCH DESIGN

Understanding children’s needs and preferences about their schoolyard benefits from a qualitative research approach, which reflects the nuances in their opinions. However, using a quantitative methodology would be beneficial in understanding their preferences on a larger scale, which is key in designing a schoolyard. Adopting an approach that contains qualitative and quantitative research elements allows for a more accurate reflection of the children’s experiences while ensuring broader support within the population. The methodology of fuzzy cognitive mapping (FCM) was adopted to capture the complexities of these spaces. It allows for an assessment of both the individual and collective understanding of the space.

This thesis employs the FCM methodology while adopting a comparative case study approach. The following chapter introduces fuzzy cognitive mapping, the project context, and the sampling process. Lastly, ethical considerations, methodological adjustments, and positionality will be discussed.

4.1 Fuzzy Cognitive Mapping

Fuzzy cognitive mapping is ‘a technique for modelling complex real-world situations, aiming at integrating knowledge from multiple actors, disciplines and sectors’ (Pluchinotta et al., 2019, p. 2). Cognitive maps (credited to Tolman, 1948) were initially used in a human systems context by Axelrod (1976) and that Kosko (1986) combined this with the concept of fuzzy, leading to fuzzy cognitive mapping (Olazabal & Pascual, 2016). He believed that the method would be especially useful for soft knowledge disciplines, as it encourages reflection and negotiation, leading to answers that incorporate several perspectives (Olazabal & Pascual, 2016; Assunção et al., 2020). FCM falls under the umbrella of problem structuring methods (Assunção et al., 2020) and initially gained significant popularity within the environmental sciences (Olazabal & Pascual, 2016).

While this method was not initially used in relation to urban design and planning, it is increasingly recognised to be a suitable to explore the complexities of issues within these disciplines, as it is tool (e.g., Pluchinotta et al., 2019; Olazabal & Pascual, 2016). Xirogiannis et al. (2004) describe that urban design is a complex process with many stakeholders. They argue that other methods do not do this complexity justice but that FCMs can be used to convey this complexity and produce new insights.

As the greening of schoolyards is a phenomenon with many stakeholders and considerations, fuzzy cognitive mapping is a helpful tool to explore this multiplicity and translate it into an analysis that displays the resulting nuance. For the same reason, this method was chosen as a part of the CoolSchools research design. Cognitive maps are used to depict networks of ideas, specifically, someone’s

opinions. These opinions are portrayed as nodes, which are interconnected to show the relationship between these concepts. These links can be positive or negative and vary in strength (Assunção et al., 2020). In fuzzy cognitive mapping, the difference is in the ability to ‘analyze cause-and-effect relationships between variables dynamically and quantitatively’ (Assunção et al., 2020, p. 264). This allows for scenarios to be created in which the potential effects of changes can be calculated to improve the understanding of the interconnectedness of these nodes (Pluchinotta et al., 2019). These scenarios will be elaborated upon in section 4.5.

These fuzzy cognitive maps (FCMs) have four elements (Assunção et al., 2020): criteria (the relevant concepts), VectorA (which depicts the value of the concept, between 0 and 1), arrows (between the concepts, depicting the causal relationships) and a matrix (with corresponding values. In assigning these values, the cognitive map becomes fuzzy, creating a social map that combines the individual cognitive maps (Pluchinotta et al., 2019). It is this combined vision that makes fuzzy cognitive mapping an especially useful method, combining the benefits of qualitative and quantitative research into one coherent output (Olazabal & Pascual, 2016). Fuzzy cognitive mapping can capture complex thoughts more than other quantitative methods while also allowing for scenario development, which is rare within qualitative methods. Nonetheless, creating FCMs necessitates simplifications, potentially reducing the value of the produced map (Văidianu et al., 2014). While it is best used in complement with other methodologies (Olazabal & Pascual, 2016), fuzzy cognitive mapping is utilised here as the main tool. It is combined with knowledge gained from unstructured observation and informal conversations with school staff.

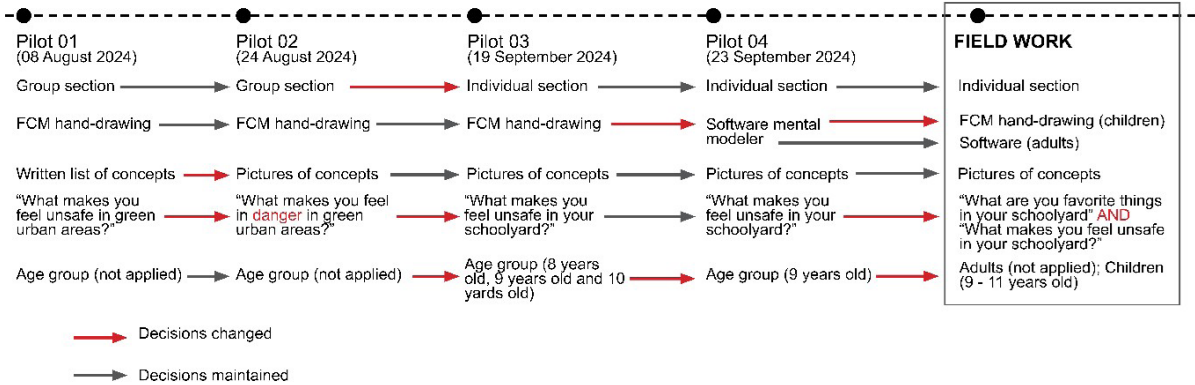
4.2 Adaptations

Punch (2002) categorised three strands of research with children: treating them identically to adults, completely differently, or similarly but with adaptations. The latter option was chosen here because children are competent social actors, but research cannot be conducted in an identical manner. Several pilots were conducted by the author in collaboration with another researcher, to assess the necessary adaptations, summarised in Figure 5.

Two pilots conducted in a group setting showed that this obfuscated inter-group differences significantly. While individual FCMs are more time-consuming to conduct, they avoid the issue where few participants dominate the conversation and, thus, the outcome. This is key to better understanding gender dynamics in a schoolyard, where group dynamics might transfer from that space into a group FCM setting.

These adjustments are in accordance with prior research concerning methodological questions in children’s research, such as the importance of images to spark discussion (Fargas-Malet et al., 2010). Concept images were used to increase mutual understanding of the concepts and start the conversation. One such concept is ‘football field’, which was accompanied by two photos of football fields. These concepts were based on prior research findings and adjusted according to the pilots. Similarly, hand-drawn FCMs were preferred to allow the children an increased sense of agency and have them engage directly with the produced data. The children were first asked about their favourite place in the schoolyard, allowing for the conversation to start more easily. From there, children were asked about what elements they liked in their schoolyard, which was connected to quality in the FCMs. The concept of safety was frequently brought up by the children themselves, but otherwise, the researcher brought it up near the end of the conversation. The pilots were conducted with several children of different ages to test what age would be most suitable for FCMs while still making regular use of the schoolyard. These pilots indicated that children between the ages of nine and eleven would comprehend the reasoning behind FCMs but also use the play spaces frequently.

Figure 5
Adjustment of the research design according to pilots conducted. Source: Presser et al. (to be published).



4.3 CoolSchools and sampling

This thesis was conducted in the context of the CoolSchools research project. Rotterdam is one of the four cities studied within the project, with a focus on the newly implemented green-blue schoolyards subsidised by the municipality. The research was conducted in collaboration with a doctoral candidate from the

University of Twente and her supervision team. The use of FCM and the case study was specified beforehand, but the research design was decided in collaboration. The author collected and analysed all data for this thesis, with a distinct research focus from the wider project. Collaborating with this project allowed for collaboration with the project partners, including the City of Rotterdam and IVN Natuureducatie, who contributed to reaching out to potential schools. Despite these ‘insiders’, finding schools willing to participate was time-consuming, and 43 schools were approached. A variety of ‘gatekeepers’ needed to approve before research could be conducted (Fargas-Malet et al., 2010), which delayed the start of the research significantly. Although initially planned for September 2024, the data was collected in December 2024 and January 2025.

Four schools accepted the interview request, but only two of the schools are analysed here. As explained in the case study section, these schools provided an interesting contrast in their design. Further details are provided in Table 1.

Table 1
Summary of the data collection.

	Location	Total participants	Number of boys	Number of girls	Dates	Open schoolyard?
School 1	Provenierswijk	17	5	12	December 2024, January 2025	Physically enclosed, open if supervision available
School 2	Spangen	18	8	10	January 2025	Physically open, no supervision after school

Due to the number of gatekeepers, there is a significant chance of sampling bias. The directors, teachers, parents and children were all required to provide informed consent before the FCM exercise, and it is most likely that those who have an interest in green spaces or a related topic would answer positively.

This research was conducted as part of the COOLSCHOOLS project, financed by the Dutch National Research Council (NWO). The author of this thesis completed an internship as part of the COOLSCHOOLS project, which allowed the author to join data collection and use parts of the data generated. The research has received ethics approval, or Ethics Guidance as called at the University of Twente (reference to #230197), which includes guidelines for obtaining informed consent. Unfortunately, as the research needed to use gatekeepers to reach research participants, not the entire procedure was under the control of the researchers, and a breach was noted. Subsequently, the breach has been properly addressed, reparation measures were taken, and Ethics Guidance was updated. For all data used in data analyses, proper and full consent was given for the use of the data.

For logistical reasons, the data collection had to be conducted at the school during class hours. This raises several concerns, as it could replicate the school environment, potentially leading to a child feeling forced to participate and give desirable answers (Einarsdóttir, 2007). One alternative to this is using rooms different from the normal classroom. In school one, the FCMs were conducted in art and kindergarten classrooms, whereas in school two, an office was used. Using these spaces gave the participants privacy to voice their opinions and kept the environment separate from the classroom setting.

4.4 Analysis

FCM can lead to several types of information, including which variables are mentioned most frequently, the centrality of the variable, the density of the map, the average weights of the connections and the complexity of the map (Özesmi & Özesmi, 2004). Centrality refers to the number of connections from one variable to the others, while the average weights of these connections indicate how strongly someone relates to the topic. The density denotes whether there are many relationships between variables, and the complexity is understood in terms of the ratio between receiver and transmitter variables. A map is more complex if it has a larger ratio, as it emphasises more outcomes than controlling variables (Özesmi & Özesmi, 2004). To produce this information, the software MentalModeler was utilised. The children's FCMs were transferred into this software, which then produces these statistics, as well as several different formats in which the data is stored.

Besides these more statistical insights, FCMs can also be aggregated into 'social maps' by combining the individual FCMs. A shared social map can be created by combining the matrices produced by MentalModeler. This map includes the concepts from the children and the values they assigned. The individuals assigned values between -1 and 1 to each connection, which are added up within this map. If one participant assigns a negative value and the other a positive one, the relationship is combined, allowing the total social map to display the average of the assigned values (Özesmi & Özesmi, 2004). Combining these matrices into a social map is done using R studio.

To produce a social map that is less cluttered, the data should be cleaned, and a common terminology needs to be produced (Özesmi & Özesmi, 2004). This data cleaning consists of combining similar concepts into one, such as 'High slide' and 'Metal slide', into 'Slide'. While this removes some nuance and introduces the potential for bias, it is necessary to produce a social map. The full breakdown of the terminology and the coding choices is in the appendix. Coding was done by the author and discussed with the CoolSchools team to strengthen the reliability and minimise the researcher's bias.

4.5 Scenario approach

A key advantage of using FCMs is the ability to run scenarios, indicating potential answers to 'what-if' questions. FCM scenario analysis consists of changing the assigned weights to different connections (Tsadiras & Bassiliades, 2013), to produce a simulation to test potential interventions. It should be noted that this analysis does not aim to predict the future, but suggests 'one possible future outcome' (Porter, 1985, p. 63). As these scenarios are not yet fully developed, caution is necessary (Wildenberg et al., 2013). Still, they provide a promising avenue of research, potentially being key in future-oriented research (Buytendijk et al., 2010). Moreover, running such scenarios can uncover how interventions regarding one connection can impact the wider system. This reflected complexity is crucial in assessing potential interventions (Zarei et al., 2024).

While there are different models to conduct FCM scenarios, FCMapper was preferred here, due to its ease of use. The software calculates an initial scenario, against which the adjusted scenarios are compared (Zarei et al., 2024). Scenarios are adjusted by assigning a different value to a concept than in the original map. This value can range between 0 and 1, with a value of 0 indicating that the concept is not present in the scenario. A value of 1 equals the concept being present at the highest frequency (Zarei et al., 2024). If no value is assigned, the value from the original system is used. When a scenario is run, the concepts that have been assigned a new value will be kept at that value. By keeping these values constant, it becomes possible to assess the results of potential interventions (Zarei et al., 2024). When running scenarios, each scenario is run twenty times, to reach the 'steady state', or the equilibrium. After this equilibrium has been reached, additional runs of the scenario will have minimal changes, allowing for conclusions to be drawn. For the mathematical background on this approach, the paper by Zanjirchi et al. provides a clear background (2020).

Constructing scenarios requires a careful consideration of what is realistic and relevant (Zanjirchi et al., 2020). Within this thesis, concepts are not reduced to zero, as most concepts cannot be guaranteed to be completely absent. As running scenarios where every concept has been adjusted is not possible, only a number of concepts can be adjusted per run, necessitating a prioritisation of potential scenarios (Zanjirchi et al., 2020). The scenarios were based on the participants' most frequently discussed concepts.

5. RESULTS

5. RESULTS

The following chapter presents the results relating to the schoolyards in Rotterdam.

The research questions were:

- **How do children perceive the design of their schoolyards?**
- What is the design of these schoolyards?
- How are these perceptions gendered?
- Does the openness of a schoolyard impact the children’s perceptions?

A modelling with scenarios was also conducted, asking the question on what concepts could be adjusted to improve the quality as perceived by the children. To contextualise the findings, the characteristics of the participants are introduced, based on a survey conducted before each exercise. Finally, several scenarios are considered, analysing the potential of changes proposed by the children.

This chapter is divided into sections comparing the findings between the schools, followed by a gendered analysis and complemented by the scenario analysis. The comparison between schools is done at three different levels, starting with the level of the schoolyard. This is followed by a section about the impact of the school context and the wider neighbourhood context. These sections will be presented using the insights from the FCMs, complemented by quotes and supported by the underlying statistics. The themes focused on here are largely drawn from the aggregated maps, Figure 9 and 10. The first step in the analysis was to select elements mentioned by three or more children, focusing on what is preferred by a larger number of children. These have been displayed within Figure 7 and 8. The total fuzzy cognitive maps, displaying each connection made by the children, will provide additional insight. These are complemented by the scenario analysis, in which the focus is on the concepts most important to the children.

5.1 Background characteristics in the sample

In total 35 children were interviewed. A questionnaire was completed by each participant, which is attached in the appendix and was approved by the ethics board of the ITC faculty of the University of Twente (as described in Chapter 4). The questionnaire comprised questions pertaining to the child’s age, gender, whether they used the schoolyard outside of class hours, and why (not). Additionally, children were asked how they got to school (modal choice), and how long this took. Below, the main background characteristics are summarised, including gender, age and mode of transportation.

Table 2

Total sample of participants, including gender and school.

	Boys	Girls	Total
School 1	5	12	17
School 2	8	10	18
Total	13	22	35

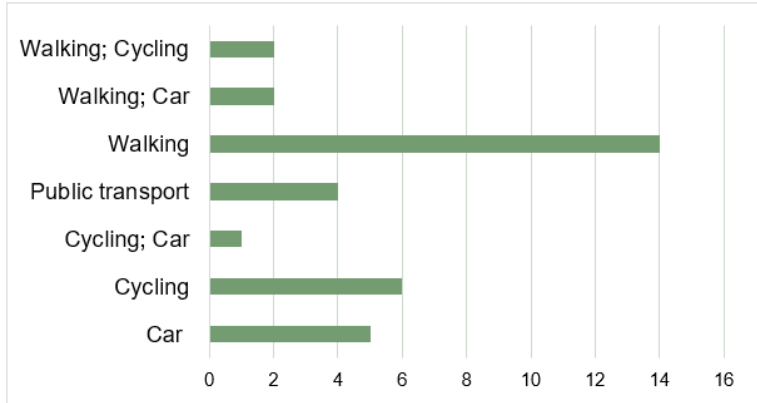
While the aim was to achieve gender parity within the sample, this was only partially achieved. Girls made up nearly two thirds (62%) of the sample. The distribution is more unequal within School 1, where two male participants (or their guardians) withdrew consent within the appeal timeframe. Despite this discrepancy, both boys and girls were well represented within the sample, as shown in Table 2.

The pilots conducted in preparation of this research (see Chapter 4) showed that children between the ages of 9 and 11 would be the most suitable participants, as they were able to create clear cognitive maps, while being more likely to regularly play outdoors. The youngest children interviewed in the pilots struggled to connect the concepts and felt less comfortable speaking to a stranger. The older children interviewed played outside less and were often no longer attending elementary school. However, obtaining parents’ consent for enough children was challenging. To ensure an adequate sample, the age range for participants was expanded, with the youngest child being 8 years old and the oldest being 13 years old. While some of the challenges encountered during the pilots were present during the research, they were relatively minimal. Moreover, most of the children were between 9 and 11 years old, with the average age being 10.5 years. Although other information, like the children’s ethnic background or the household income, would have been interesting, the ethics board did not provide permission for this within this research. Overall, the sample was quite diverse in terms of ethnic backgrounds, although it is not clear if this was representative of each neighbourhood.

Although the focus within this thesis is on the children’s perceptions of their schoolyard, they were also asked about how they get to school. As was described in Chapter 2, being able to reach play spaces independently is key in a child-friendly neighbourhood. The majority of the children within the sample walk to their school, with others cycling, taking public transport or being brought by car. The modal choice of some children varied per day, such as the children who walk or cycle, indicated here as ‘walking; cycling’. Although the results presented below are

inevitably a simplification, it provides insight into their potential independence. Especially with additional traffic calming interventions, the majority of participants would be able to reach school independently. This is key in maximising the benefits of an improved schoolyard.

Figure 6
Modal choice in the sample.



5.2 The schoolyard

Presented hereafter are the concepts associated with schoolyard design, including preferred equipment, activities and other design elements. This category was of great interest to the children in both schools, with a large number of concepts belonging to it. While the children in both schools felt strongly about their schoolyard design, this looked significantly different between the two schools.

Figure 7
Aggregated map School 1, with only the returning elements selected.

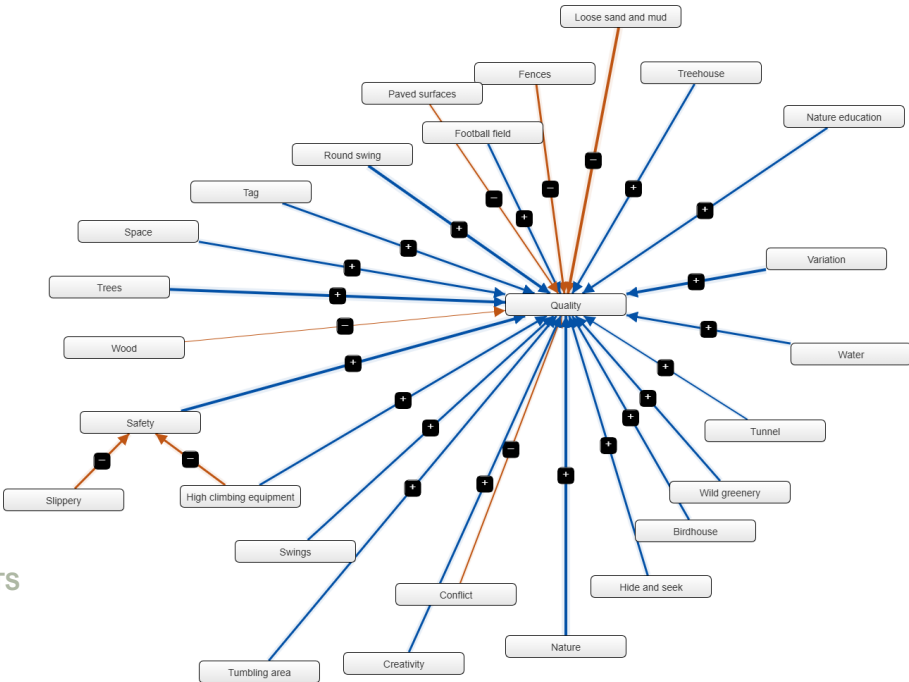


Figure 8
Aggregated map School 2, with only the returning elements selected.

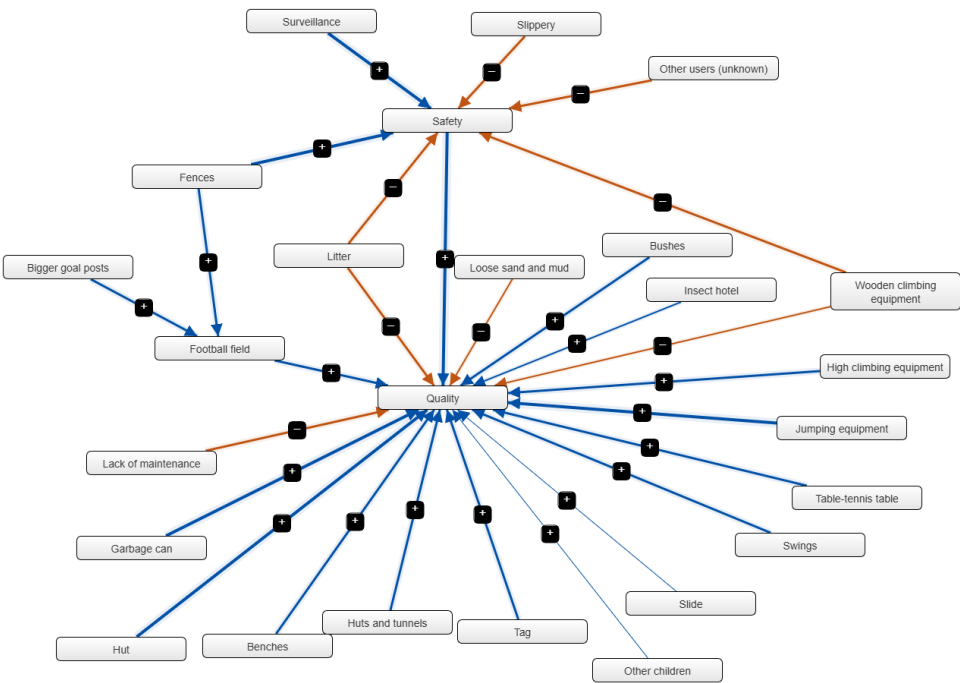
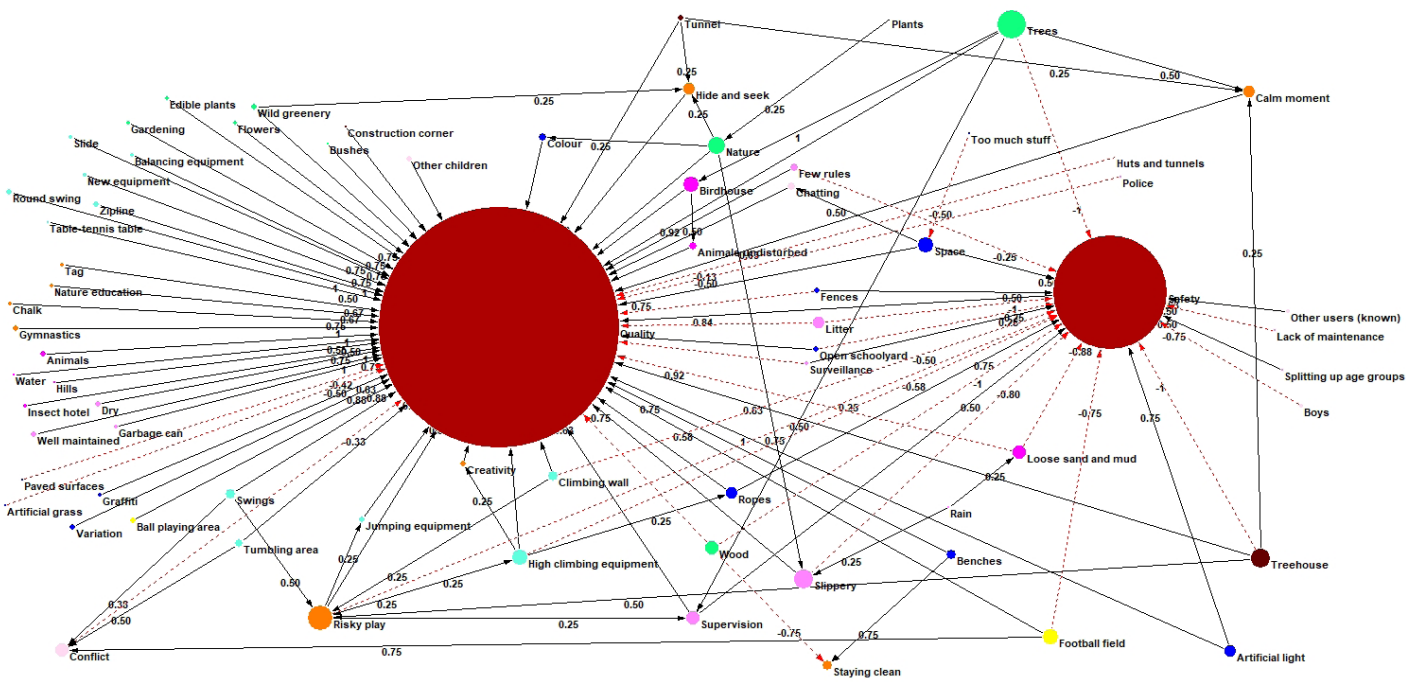


Figure 9
Aggregated map for School 1.



elements could be a potential factor contributing to this discrepancy. While in School 1, there is a large variety of these, in School 2, this variety is much smaller. Moreover, while in School 1 the children only have weekly access to a football field nearby, in School 2 the football field takes up a sizeable portion of the schoolyard.

The importance of the football field in School 2 is further reflected in its high centrality, as is displayed in Figure 10. Many children discussed the football field at length, as the school had implemented new regulations recently. Previously, there was one large football field, which was often dominated by the older, often male pupils. Instead, the staff split up the football field, placing two smaller goals on each side. While the aim was to reduce conflict, this was a controversial topic amongst the children. According to many of the students, this negatively impacted their experience, causing more conflict and frustration. Five children specifically believed bigger goal posts (usually implying a return to the original field) would solve this. A range of other factors were also discussed including better maintenance, additional space and additional fences. This relative centrality and the popularity indicates the importance of the football field for these pupils, being key in their schoolyard.

Natural elements

In School 1, nine of the twenty-four concepts in the selected aggregated map were related to greenery. From this predominance, it is clear that these children appreciate natural elements. Moreover, there is a significant diversity in the natural elements mentioned in this school, including water, birdhouses and wild greenery, displayed in Figure 7. This is a strong indication that the children actively pay attention to the various aspects of nature and appreciate its diversity. Most of these pupils spoke with a sense of respect for the natural elements, with one girl wishing that animals could take a break away from the busy children. The children understood the balance between respecting nature, while also being able to play in and with it. Whether this was hiding in the bushes or climbing the trees, the children enjoyed it all. A large part of the schoolyard is covered in natural elements, with only a small, paved path leading to the different entrances. The relative popularity of natural elements within this school thus reflects the design of the schoolyard.

Less popular was wood, which has a negative score, although some children liked it. One child explained that he was mainly concerned about falling, as ‘there was a time that someone broke their nose, because it was very slippery’. Only one natural element was largely attributed negative values: loose sand and mud. Some children simply considered this boring and meant for younger children, with others

complaining about the resulting mess. Similar concerns were echoed in School 2, although the average value assigned to loose sand and mud was less negative. While in School 1, a variety of natural elements were mentioned in a positive manner, but in School 2 only two natural elements were considered by more than three children as positive factors. The bushes and the insect hotel were seen as positive contributors, although one of these positive mentions was specified with the request for an ‘insect prison’ instead. The pupil requested that the holes would all be filled or at least have a lock, believing this to be safer for the pupils and the insects.

Activities

The children emphasised that a schoolyard also needs to accommodate a range of activities, including games of tag and hide and seek. The former was popular in both schools, the latter only in School 1. When hide and seek was discussed by children in the second school, this was formulated as a complaint: there were no places to hide. In the first school, this was rather different, with pupils talking about hiding in tunnels and the treehouse. The tunnels were largely popular for their suitability when playing hide and seek, with two children considering it a space to find some serenity in the busy schoolyard. Similarly, the treehouse was liked for its ability to hide, in a playful context, but also when needing a moment away. Three children also discussed creativity, mostly referring to free-building elements like sticks and clay, to build with in an open-ended way.

In School 2, the huts and tunnels were mentioned for similar reasons, to improve the hide-and-seek situation and provide some spaces to take a break. Benches and huts were popular in this school, and often combined. In their schoolyard, there is no covered area, leaving the children to either stay inside or get drenched, with several children not having appropriate rain-gear. In School 1, there is a large hut with benches and a firepit, which is also used as an outdoor classroom. A picture of this hut was utilised in a concept card, with several children of School 2 asking for exactly that hut in their own schoolyard.

In School 1, there is a dedicated teacher for weekly nature educational classes, for all students. The class is taught in this hut, even in winter, and the children are encouraged to explore their schoolyard during class. Occasionally, the hut was also used for classes like math or spelling, even venturing into the schoolyard with different assignments. Three children mentioned nature education in this school, all seeing it as a positive element. A child in School 2 expressed a desire for a similar initiative, saying that ‘sometimes we want other things too, doing maths outside on benches’.

Safety

Regarding the safety of the schoolyard, most children were specifically concerned during rainy weather. In both schools, several children said that slippery equipment or floors were dangerous, especially for younger children. In School 2, this was especially mentioned in reference to the wooden climbing equipment referred to earlier, and in School 1 this was a concern throughout the schoolyard, with five children mentioning it. Seven children in School 2 mentioned the wooden climbing equipment as dangerous. This danger was partially a result of the height of the equipment, and the lack of guiding ropes. In School 1, two children explained that the climbing equipment was much safer due to ropes and other handholds, which could prevent children from falling.

5.3 The school

Although the elements available in the schoolyard are important, the school and its staff also play an important role. Within this section, the concepts discussed were more divergent and challenging to combine, meaning that the focus is more on the diversity of concepts mentioned, rather than the frequency.

Rules and supervision

A wide range of concepts pertain to the regulations within the schoolyard and the supervision from staff or family. In School 1, children discussed the splitting up of different classes according to time, considered to increase the safety within the schoolyard. Another child brought up that compared to other schools, there were relatively few rules, which allowed for risky play. She saw this as positive for the quality, as children were allowed to do much more, but she did believe this was negatively impacting the safety. Nonetheless, she described this as a worthy trade-off, assigning the positive impact to quality the highest value (1), with the safety impact only being -0.25.

Several children also believed that having supervision, whether from teachers or parents, was crucial. One child in School 1 explained that she was only allowed to play in the schoolyard after hours if her classmates' parents were there. In School 2, a girl said that she felt safe when 'grandpas and grandmas' were around, to make sure nothing would happen and there was help if someone got hurt. This supervision was considered important for safety, both in terms of equipment and social safety, but also needed to resolve conflict in the schoolyard. A girl from School 2 felt that both the football field and swings led to many discussions, with one boy begrudgingly admitting that the football conflicts would often continue in the classroom. The physical education teacher explained that he was now in charge of supervising the

football games, to resolve such discussions. These examples, although varied and not as frequent, highlight that the role of the teachers and other adults is key in the children's experience.

The presence of other children was also discussed by several participants, with this being seen as largely positive when it concerned classmates, but negative when it concerned children not enrolled in the class. In School 2, a pupil described unknown children entering the schoolyard during class breaks and play along, but one child described that they would not adhere to the rules, as teachers could not enforce these.

Education and maintenance

The role of the teacher is key not just as a supervisor and peacekeeper during lunch breaks, but in their ability to foster knowledge and appreciation for the schoolyard and the nature within it. For instance, in School 1 the position of gardener is combined with teaching nature education. The hut is his classroom, as well as the larger schoolyard, and the weekly class is beloved by many of the pupils. The children engage with nature, learn directly about the importance of biodiversity, animals and much more, while also getting outside during school hours. Even outside of the dedicated class hours, some children choose to spend their lunch breaks with the teacher, taking care of the schoolyard and the plants. This means that maintenance is a shared activity, rather than a task done after school hours. One teacher felt that this shared responsibility encouraged the children to be more mindful of their behaviour and take better care of the schoolyard. In each school, one child mentioned that a lack of maintenance could be dangerous. Furthermore, three children in that school believed that a lack of maintenance would negatively impact the quality of the schoolyard. The lack of maintenance in this context meant broken pavement, equipment that was falling apart and dying flowers. Similarly, three children in School 2 mentioned that a well-maintained schoolyard would be vital to them, and one felt it would also make the area safer.

5.4 Neighbourhood level

The final scale on which schoolyards are examined here is the neighbourhood level. Both the architectural design of the schoolyard and the social consequences in the schoolyard are discussed.

Schoolyard amenities

While the following concepts are part of the schoolyard design, they relate less to play and more to the relationship between the schoolyard and the neighbourhood, which is why they are discussed here. In School 1, these nonetheless relate more to play, including an appreciation for variation and having enough space to play. Moreover, paved surfaces were mentioned by several children, whether as a space for cycling or the fear of injuries on the pavement. Fences were mentioned by three children, who all considered it a negative factor. On the other hand, two children said they did not like having a schoolyard that was publicly accessible after hours, with one explaining that this led to more litter. In School 2, children felt quite the opposite, with four children feeling that fences would make the schoolyard safer and three believing fences would improve the football field specifically.

The contrasting opinions on fencing are rather interesting, as they mirror what is in the children’s daily reality: the children with an open schoolyard would prefer a closed schoolyard, and vice versa. This is especially interesting as most components largely reflect the existing schoolyard, with the children frequently preferring what is in their own schoolyard.

A potential reason for the desired fences in School 2 is the range of issues the children face daily, as a result of the open schoolyard. For instance, seven children discussed the presence of litter in their schoolyard as negatively impacting the quality, with four of them even considering it as dangerous. In comparison, only one child in School 1 mentioned litter at all, considering it a negative factor for both quality and safety. The frequency of litter being brought up in School 2, is far from surprising when one visits the schoolyard, with litter around the garbage cans and in the play spaces. The research was conducted in January, and the janitor explained that the garbage cans were closed to prevent people from putting explosive fireworks in the garbage cans. He described that while he would remove some of the most dangerous objects, there was too much litter for him to deal with. Two children shared this concern of the fireworks specifically, with one child talking about a ‘cobra’ exploding near there. The lack of maintenance referred to earlier also applies to this, with increased maintenance being a solution proposed by several children.

As examined in Chapter 3, this lack of fencing allows anyone to enter the schoolyard, both during and outside of school hours. This has led to the presence of strangers, both children and adults, in the schoolyard during lunch breaks or at the end of the school day. Several children were concerned about this, with three believing these

strangers could pose a danger to them and their classmates. An administrative staff member described running into unhoused people, who would sleep on the benches in the schoolyard, when she arrived at 8 AM at the school. These safety concerns were partially spread by the children in the form of anecdotes, with one pupil telling a range of them as a basis for her worries. She had heard that ‘two girls had almost been grabbed’. The same girl described that ‘near our yard, a little boy died, at the [supermarket] or so’. The case that this pupil refers to could not be identified by the researcher, although a fifteen-year-old was murdered in an apartment bordering the school. While this happened in 2020 and was a result of an interpersonal conflict, it is logical for the children at this school to have been worried. Another pupil mentioned that it is frustrating when ‘drunk adults come bother us during football, and we do not know what we should do’, with a third explaining that ‘sometimes strange people come to the children, and that is not nice for the little children’. These concerns highlight the different concerns that dominate within the two schools, as reflected in the aggregated maps shown in Figures 9 and 10.

Likely partially related to these issues, the children in School 2 considered surveillance and police presence in a much more positive light than those of School 1. In School 1, only one pupil mentioned the police, saying it would negatively impact the quality of the schoolyard. In comparison, two pupils in School 2 described the police as a positive factor for safety, with one also believing it would increase the quality of the schoolyard. In School 1, two children mentioned surveillance, specifically cameras, as negatively impacting their quality experience. One of these two children did believe that surveillance could improve the safety of the schoolyard, but only slightly. In School 2, four children felt that surveillance cameras could improve the safety. Their reasonings included protection from strangers, but was also seen as a solution to solve the conflicts between pupils, to show the ‘objective’ story of the fights. One child also felt such cameras would improve the quality of the schoolyard, in the same conflict-resolving manner.

5.5 Gendered analysis

Complementing an analysis between the two schools, this research also compares the perceptions between boys and girls. As explained previously, the girls sample was randomised into a smaller number of participants to allow for an accurate comparison with the boys. As was done above, the results will be presented using the aggregated maps, focusing on the most frequently mentioned factors. The girls selected aggregated map, pictured in Figure 11, includes twenty-one concepts, compared to the thirteen concepts in the aggregated map by the boys. It should be

noted that children from School 2 were overrepresented in both groups, which could explain some of the similarities to School 2’s aggregated map. For instance, the relative dominance of manufactured equipment as compared to natural elements is likely a result of this discrepancy between the samples.

The difference between the maps of the boys and girls is not merely in the map of the most frequently mentioned concepts but applies to the total maps as well. This is further displayed in Table 3, which shows the network statistics. The girls included more components and made more connections between these components, resulting in more complex maps. This complexity is also mirrored in the total maps, with the girls’ map significantly being more difficult to read.

The schoolyard

As was done with the comparison between the schools, three levels can be discerned from the mentioned components. Similarly to the school-level analysis, the equipment and activities in the schoolyard play a major role for the children. Overall, the boys mentioned seven types of equipment and one play activity (tag), compared to the ten types of equipment mentioned by the girls, who did not mention tag or hide-and-seek. Most popular for the boys was the football field, with 10 children mentioning the football field and other related concepts. This applies predominantly to School 2, where the adapted football field was the topic of much discussion. This is reflected in the centrality of this concept in Figure 12. The football field was also mentioned by six girls, roughly half of the included sample. For the girls, the design of the football field mattered less, with only one girl mentioning the goal posts.

Liked by both boys and girls were the swings, with all but one of the girls and nine boys discussing them. This was the most popular item across the board, with all children assigning it a positive value. Three girls mentioned liking the round swing, while two boys felt that it could be dangerous if someone fell from the basket. One boy also believed that the individual swings could be used for risky play, by swinging fast and high. In both groups, a child felt that the swings could also be a source of conflict, mirroring the feelings of the teacher quoted earlier.

Also enjoyed by boys and girls was high climbing equipment, although less than the swings. Five girls and seven boys considered it an element that positively affects the quality, although three girls also considered it unsafe. Three boys also described the specific wooden climbing equipment in School 2 as unsafe, while three girls felt that

this equipment negatively impacted the quality. Equipment like the table-tennis table and the jumping equipment was discussed by both groups. Six boys mentioned the slide, and three brought up the game of tag. These were not mentioned by many girls, who instead discussed tumble bars, balancing equipment and huts and tunnels.

The complete maps include a similar number of natural elements in each map, but the frequency of the components varies strongly between the boys and girls. Whereas flowers were the only natural elements mentioned by three boys, the girls discussed water, birdhouses and loose sand and mud. The latter was considered as a negative factor, predominantly for reasons related to cleanliness. Interestingly, this concern was not brought up in relation to water, which was seen by four girls as a positive element. Zero girls mentioned flowers, focusing more on other greenery such as edible plants and trees.

When it comes to the amenities within the schoolyard, the girls discussed two main topics, namely benches and huts. Three girls described wanting a hut, with benches being twice as popular. Huts were also considered as a place that could allow for a calm moment, with trees and tunnels providing other suitable spaces. Benches in return were considered as a method to reduce conflict, especially in the second schoolyard, where there was limited seating available. Three girls also discussed graffiti, although one girl disliked it. It should be noted that the two girls who positively mentioned graffiti, seemed to refer to colourful street-art. Both girls spoke positively of having more colour in their schoolyard, indicating that it was much lacking in cheer.

Lastly, five girls shared the concern that the schoolyard could be rather unsafe during the rain, as equipment could become slippery. This concern was particularly dominant regarding the climbing equipment, both the more general concept and the specific equipment within School 2.

The school

Several girls referred to two concepts in this category: other children and nature education. Both concepts were mentioned by three girls, in positive manners. Three girls mentioned nature education to improve their schoolyard experience, although they did not elaborate on this much. Concepts pertaining to this topic were not mentioned by more than one male participant.

In both total maps, supervision is connected to quality and safety, with a girl specifying that more trees allowed for more supervision, while a boy believed that additional supervision would encourage more risky play. One boy felt that the presence of adults he knew would make the schoolyard safer, with a girl saying that such adults made the schoolyard more enjoyable. One girl also mentioned that the presence of boys made for a less safe schoolyard, specifically as a result of football-related conflicts. Conflict was present in both complete figures, with girls also drawing connections to what could reduce this. While swings were seen to lead to an increase in conflict, additional benches and more variation could reduce the tensions in the schoolyard. The same connection between swings and conflict was drawn by the boys, who also felt that the tumble bars could increase conflict. In their eyes, increasing the size of the goal posts could reduce the conflict, as described in the schoolyard comparison.

The neighbourhood

Much more central in the girls' map are litter and unknown adults, indicating that they considered what factors influenced these components, as is shown in Figure 11. As litter was mentioned by several girls, it is included in Figure 13. The presence of unknown adults and the connected factors were only mentioned by one or two girls, meaning that they were not included in this figure. Additional fencing was considered as a method to prevent transfers from entering, with bushes being considered by one girl for the same purpose. Several girls felt that these unknown adults would make them feel unsafe, as well as reduce the quality of the schoolyard. Moreover, they believed that both adults and children (not from their school) would leave litter in their schoolyard, further negatively impacting them. Three girls connected litter and quality negatively, equal to those who connected it to safety.

Contrastingly, five boys felt that litter would negatively impact quality, with only one connecting it to safety. Instead, the main topics pertaining to safety were the presence of surveillance and fencing. Both were seen as positive by three boys each. These were not nearly as popular amongst the girls, although they also connected these concepts to safety. Garbage cans were also mentioned by several boys, believed to positively impact quality. Although mentioned by fewer girls, Figure 13 shows that girls also believed that garbage cans could help reduce the litter in the schoolyard. In comparison, the concept 'well maintained' was more central in the map created by the boys. This can be explained partially by their focus on a well-maintained football field, increasing the importance of this concept.

Table 3
Network statistics for aggregated maps.

	School 1	School 2	Boys	Girls (adjusted)
Number of components	73	63	67	82
Number of connections	116	92	89	115
Density	0.02	0.02	0.02	0.02
Most central components	Trees, risky play	Football field, conflict	Football field, trees	Litter, football field
Number of driver components	53	52	58	64
Number of receiver components	2	2	1	2
Number of ordinary components	18	9	8	16
Complexity score	0.038	0.038	0.017	0.031

Figure 11
Displaying the total aggregated map for the girls.

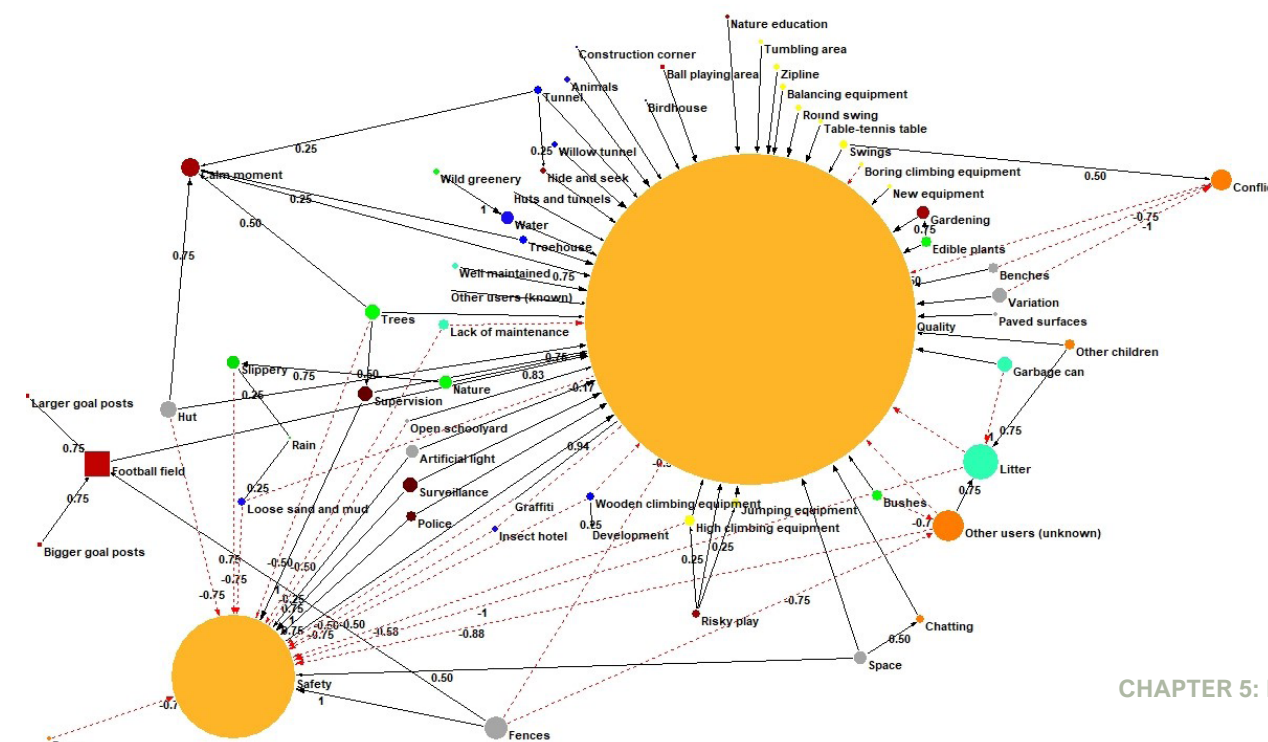


Figure 12
Displaying the total aggregated map for the boys.

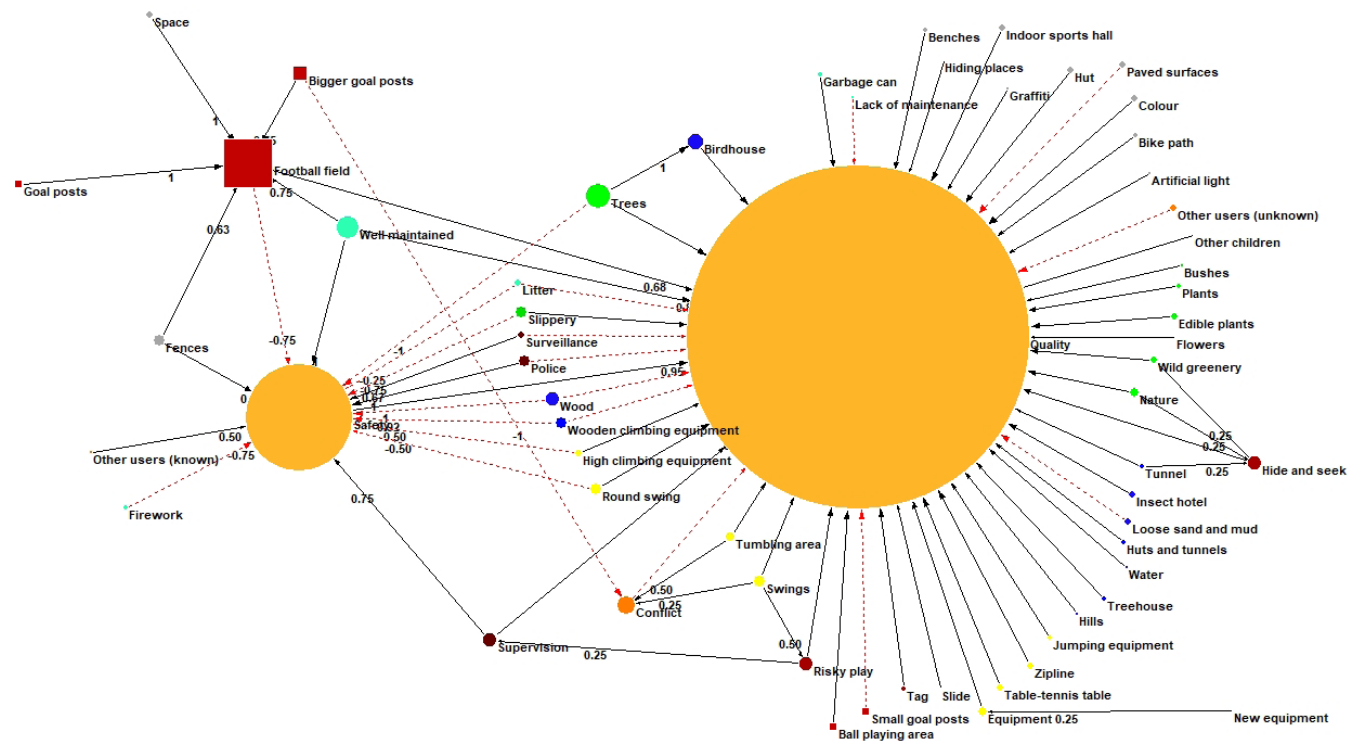


Figure 13
Aggregated map for the girls, with only the returning elements selected.

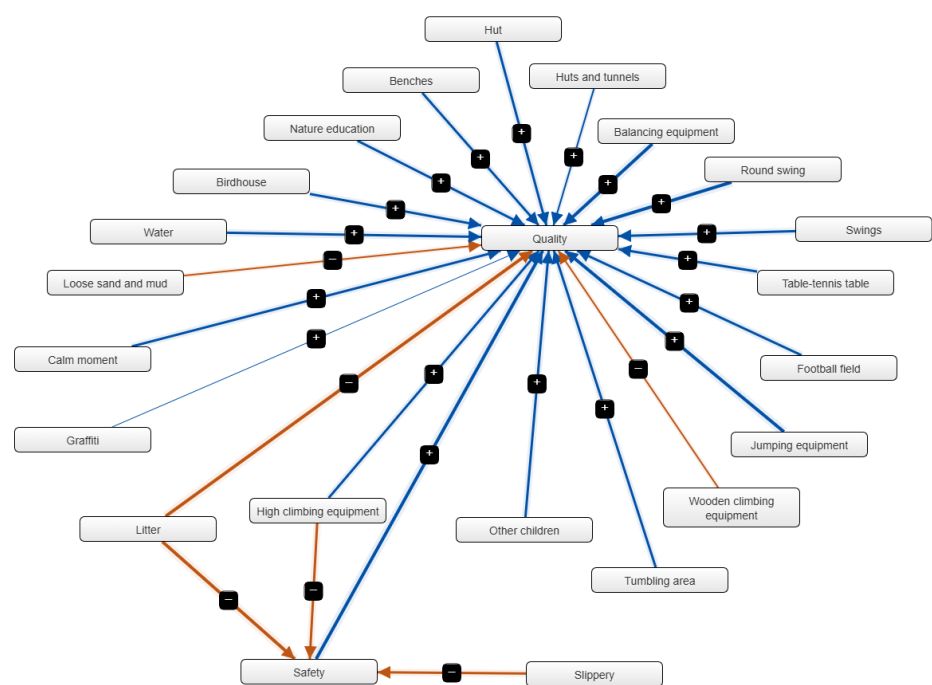
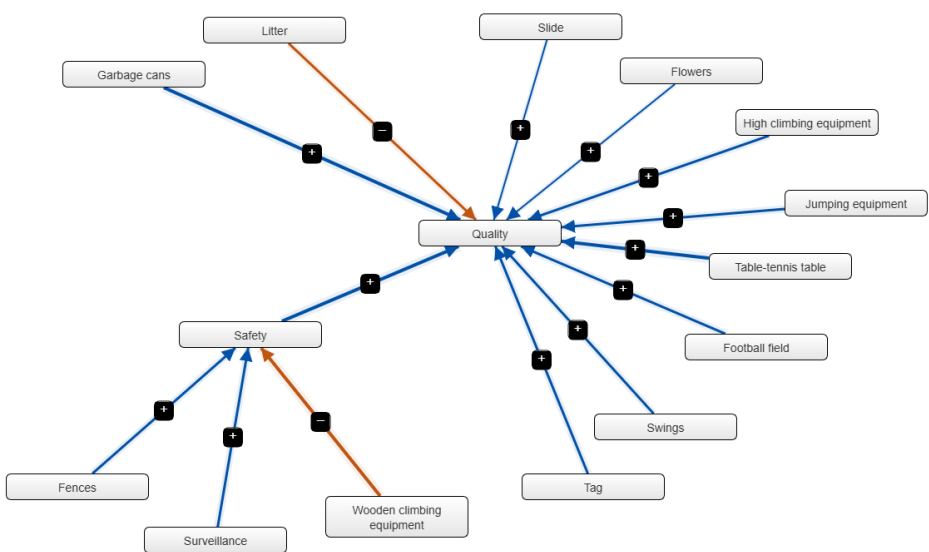


Figure 14
Aggregated map for the boys, with only the returning elements selected.



The total social maps displayed here were visualised using Pajek software. While the aim was to colour-code the categories according to the grouping attached in the appendix, this did not run without issues. Despite re-running the software, this was not resolved. To mitigate this, the elements were placed adjacent based on this categorisation. The network statistics are a different way of examining the data, although similar conclusions can be drawn. For instance, the most central elements highlight the different interests between the schools, as well as the differences between the boys and girls. The complexity score for the boys’ map is significantly lower than that of the other three groups.

5.6 Scenario analysis

The focus on this thesis is on the perceptions of the children with recommendations formulated on the scenario approach being a smaller section. The scenarios explored here are only a small sample of the possibilities with this method. Per group (School 1, School 2, boys, girls) a scenario is run, to see how quality and safety perceptions could be improved for these children. For each group, the three most mentioned concepts were chosen and assigned a value of either 0.1 or 1. Only three concepts are examined per group for the sake of brevity. Concepts such as litter and unknown adults were assigned the value of 0.1, as they negatively impacted the children and

would need to be reduced. 0 is not frequently assigned in FCM-scenarios, as it is rarely possible to completely exclude a factor. Elements like fences and swings were assigned a value of 1, as their presence were (predominantly) seen as positive, and their presence can be controlled. Safety and quality were not assigned different values, and the factors not in the included three were also assigned their original values. In the instance that several elements were mentioned by the same number of children and included in the top three, all elements were included.

FCMapper was used to conduct these scenarios, which calculates the results based off the aggregated matrix created earlier. After assigning a value between 0 and 1 to several concepts, the software calculates the impact of these new values on the other concepts. This is done a number of times, to create a ‘stable’ network. This stable state and its correlated values are then displayed in the software. The software also displays which concepts were impacted positively and negatively, along with the strength of this impact. This strength is indicated using a scale between 1 (strong change) and 4 (very weak change). The following section will present per group which scenario was run and the calculated impact of this.

The choice was made here to calculate scenarios based on the most discussed elements, rather than run several scenarios and calculate which one most positively impacted quality. This was preferred, to adhere more closely to the preferences echoed by the children. This results in scenarios that might not only have positive impacts, although these more complex results are also a more accurate portrayal of reality.

School 1

In School 1, two issues occurred with the running of the scenario. High climbing equipment was considered as key for quality perceptions, but negatively impacted safety perceptions. Furthermore, only one other element (slippery) pertaining to safety was mentioned by more than three children. Initially, the scenario was run including high climbing equipment assigned a value of 0.5, to find the balance between both points. However, this value did not work well in the scenario, thus the high climbing equipment was kept at the original value decided by the children. Only three variables were thus changed in this scenario: swings, football field and slippery. 94.5% of variables were changed, with three being impacted negatively. The three negatively impacted concepts were chatting, space and quality, although all the impacts were categorised as weak. Nonetheless, this means that the changes tested here would slightly decrease the quality perception. Six impacts were strong

or medium level, with conflict, safety and risky play being strongly impacted in the positive direction. It should be noted that a positive increase of conflict means that there is more conflict, positive thus only indicating the statistical direction. The proposed changes would thus mean that the schoolyard is overall much safer, despite an increase in conflict and in risky play.

School 2

The scenario for School 2 included seven changed concepts, with table-tennis table, football field and swings pertaining to quality. Litter and the wooden climbing equipment were assigned a value of 0.1, while fences and surveillance were assigned a value of 1.0 to increase the safety of this schoolyard. 87.5% of variables were impacted by these changes, with two concepts being impacted negatively. Both negative impacts were categorised as strong, thus indicating a significant decrease in development and the presence of unknown adults. The latter is a positive impact for the children, despite being negative numerically. The only other variables affected strongly were conflict and safety, both of which increase strongly as a result of these changes.

Boys

To run the scenario that adheres to the wishes of the boys, the football field, high climbing equipment and swings were assigned a value of 1.0. Also assigned a value of 1.0 were the concepts of surveillance and fences, meant to improve safety. Lastly, the wooden climbing equipment was assigned a value of 0.1, to reduce its risks to safety. These changes impacted 88.9% of variables, all of which were impacted positively. Most variables were impacted only weakly, except for conflict, safety, risky play and supervision. The first of these three concepts were impacted strongly, although it should be noted that a positive change of conflict indicates an increase in conflict. By making the according changes, the schoolyard would thus become safer, despite more children partaking in risky play. Although there would be more supervision available, there would be significantly more conflict, and only a small increase in quality perceptions.

Girls

The scenario run for the girls included four elements pertaining to quality: swings, table-tennis tables, benches and football field. The concepts that relate to safety were slippery, high climbing equipment and litter. The first four were assigned a value of 1.0, indicating that the availability of these elements would be increased, with the latter three concepts being assigned a value of 0.1, to limit their presence. 87.5% of

variables impacted by these changes, with two concepts being negatively impacted and the remaining being positively impacted. Conflict and the presence of unknown adults were impacted negatively, meaning that a schoolyard that incorporates these changes would have less conflict and less strangers. Conflict was impacted strongly, with safety being the only other strongly affected variable. This schoolyard would thus be considered much safer by the girls, although the quality perceptions would merely improve weakly.

6. DISCUSSION

6. DISCUSSION

This thesis aimed to assess children’s understanding of their schoolyard, focusing on the factors that contribute to their perceptions of quality and safety. Three main research avenues were explored, those of greenness, gender and openness, throughout three levels: the school, the schoolyard and the neighbourhood. The results tell a rich story, shared by children excited to participate. The children’s perceptions largely echoed their own schoolyard, with the opinions reflecting the differences between the two schoolyards. This tendency to mirror their own schoolyard indicates that most participants used their own schoolyard as a baseline to build upon. The pupils from School 1 created more complex maps, primarily focusing on natural elements. In School 2, the focus was predominantly on manufactured equipment and football fields, with the pupils also mentioning a significant number of negative elements. This contrast could be partially attributed to the children focusing on what is familiar to them, thus predominantly reflecting their own schoolyard. Especially the presence of negative elements in School 2 could be related to the openness of the schoolyard, as the closed schoolyard of School 1 has few mentions of such elements.

Due to the methodology, certain questions, like whether children enjoy outdoor play itself, or if they play outdoors frequently, cannot be answered in this thesis. Moreover, the limited sample size further delimits the ability to answer questions with a high degree of certainty. Nonetheless, the fuzzy cognitive maps were rich in complexity and provide ample information to compare with previous studies.

While gender was examined separately within previous sections, it is incorporated with the other elements in this section. The picture painted by this analysis is relatively similar to the findings of earlier studies, but with unique insights. In this study, girls were much more likely to create complex maps, incorporating more elements and focusing more on natural elements. In the aggregated map for boys, the football field played a much more central role, mentioning limited natural elements. These differences are rather striking, both in terms of complexity and themes discussed. Furthermore, the focus on the openness of schoolyards and the combination of factors contribute to the strengths of this thesis.

6.1 Questionnaire

The survey results showed that the concerns in the sample largely reflect the national reasons contributing to the decline in outdoor play. Most of these children live near their school, with most children being able to reach their school independently, which is in line with Dutch governmental recommendations (Onderwijsraad, 2019).

Many these children do not play at the school after class hours, attributing this to busy schedules and a lack of interest in the schoolyard. Other children mentioned that they could only play there when there was supervision, in line with prior research on the decline in outdoor play.

6.2 The schoolyard

The children’s fuzzy cognitive maps, in all groups, showed a predominant interest in the design of the schoolyard and the play-supporting elements. This interest is also prominent in the existing literature, with a large number of studies focusing on this topic. In a way, each school represents a strand of this literature: one schoolyard consists mostly of manufactured equipment, and the other of natural elements. These will be elaborated upon here, organised along the themes used in the results section.

Equipment

How the children in this thesis perceived the equipment was largely in line with the findings of other studies. In both schools and both gender groups, swings were one of the most popular concepts. The interest in swings across groups has been identified previously, with this type of equipment being perceived as relatively gender-neutral (Barenie et al., 2024). The round swing was mentioned only by girls as a positive factor, while some boys expressed that it could be dangerous. This fear is not reflected in prior literature, but the round swing has previously been shown to be used predominantly by girls (Bourke & Sargisson, 2014). Rather popular with boys and girls was the high climbing equipment, both in this study and existing literature (Raney et al., 2023; Sandseter et al., 2021). The climbing equipment in School 1 was much more popular, with children in School 2 complaining that the climbing equipment in their schoolyard was boring. This highlights that children are less likely to play when they perceive their schoolyard as uninteresting, thus reducing the amount of outdoor play they engage in (Zamani, 2016)

Interestingly, pupils of both schools were concerned about the safety of such climbing equipment, with many sharing anecdotes of classmates injuring themselves. Previous work suggests that this would be lower in School 1, where children are more encouraged to engage in risky play and should thus be more adept at handling these situations (Lavrysen et al., 2017). While children in both schools shared these concerns and anecdotes, in School 1, the children were more engaged in how to prevent these falls. Several children discussed guiding ropes to safely use climbing equipment, supporting the findings of Lavrysen and colleagues.

Remarkably popular in School 2 was the table-tennis table, mentioned by twelve children, both boys and girls. Although this specific type of equipment was not explicitly discussed in other literature, it could be considered as equipment that supports competitive play. The pupils of School 2 typically used this table to play ‘round-the-table’, where a ball is passed amongst children running around the table, with the winner being the person who can keep passing the ball the longest. While prior research often highlights that boys are more likely to participate in games like this, this was not the case here. Contrastingly, the game was more popular among girls, with boys mostly participating when they did not have access to the football field.

Also popular amongst the girls were the tumble bars, or tumble areas, where they could do gymnastic tricks. Several of the girls called this their favourite space in the schoolyard, explaining that they would spend their lunch breaks there and chat to their friends. Again, this is in accordance with previous studies, which found that girls are more likely to prefer balance and coordination equipment (Pawlowski et al., 2019).

A significant discrepancy between the boys and girls in this study was their preference for slides, which was mentioned by six boys but not by any girls. Other researchers did not report this finding, and it is unclear what the reason behind this discrepancy is.

Natural elements

The natural schoolyard in this study, belonging to School 1, follows the pedagogy typically associated with such schoolyards and includes many elements mentioned in other studies (Stevenson et al., 2020). The schoolyard features various green spaces, with sand and water incorporated in several ways. The schoolyard of School 2 is predominantly concrete, with only one natural area, which looks somewhat out of place.

Fjørtoft (2004) described that natural schoolyards are more likely to encourage open-ended play, fostering creativity and independence amongst the pupils. In School 1, creativity was recognised as important in the schoolyard, while it was not mentioned in School 2. This is thus consistent with the findings by Fjørtoft (2004).

Loose sand and mud have been attributed negative values across the schools, mainly due to concerns about staying clean. This is corroborated by earlier research on

parental attitudes towards natural schoolyards, where parents expressed frustration about their children returning home with dirty clothes (Van Dijk-Wesselius et al., 2021). These concerns are likely conveyed to the children by their parents, which impacts their perceptions.

Existing research often advocates for a shift towards green playgrounds, as they could encourage girls to be more active and change the gender dynamics within the play space (Änggård, 2011; Nicksic et al., 2018). While no comparison was conducted here between the girls of School 1 and School 2, it seems that these schoolyards indeed accommodate different gender dynamics. The aggregated map created by the girls shows an interest in natural elements, which were predominantly mentioned by the girls in School 1. Moreover, the aggregated map includes various types of equipment, indicating an interest in variation in the schoolyard. School 2 has limited variation, partly due to the removal of the swings and the table-tennis table. On the other hand, School 1 has a significant variety of elements, which could be more enjoyable for the female pupils. Due to the limitations of this data, this cannot be empirically confirmed, but the results suggest that the girls in this study would prefer a natural schoolyard and engage in more outdoor play.

The results from this study further suggest that boys in School 2 were more physically active than their female classmates, with the football field being their preferred activity. A twelve-year-old boy in School 2 explained that the children ‘care for and respect each other’, saying that ‘the children who are not so good at soccer, but I choose them, so they feel like they belong’. He also said that girls were more than welcome to join the games, although one teacher explained that the girls would often end up excluded. The equipment that the girls of School 2 preferred and encouraged them to engage in physical activity was removed, specifically the swings and the table-tennis table. This further supports the suggestion that boys are more physically active than their female counterparts in more concrete schoolyards.

Moreover, unstructured observation by the author supports this point. The girls in School 1 were actively playing and interacting with boys. In School 2, the older girls spent their lunch breaks walking around or sitting on the few available benches, while the boys and a few younger girls played football. Previous research has shown that younger girls still play more, but that this decreases significantly when they get older, with them usually preferring to sit and chat (Bourke & Sargisson, 2014). Furthermore, the girls in School 2 mostly stayed near the edges of the playground or leaned against the walls of the utility building located in their schoolyard. This

marginalisation of girls towards the edge of the schoolyard was also found by Paechter and Clarke (2007).

Activities

Much of the previous research has found that football fields were much more popular amongst boys, with girls often being excluded from joining (Reimers et al., 2018). As described above, this closely mirrors what happens in School 2 and is thus in line with earlier results.

While tag was frequently discussed in both schools, hide and seek was only popular in School 1. While Karsten (2003) found that hide and seek and tag were not gender-stereotyped, they were more popular amongst boys in this research. Both groups mentioned that tunnels could be a good element for hide and seek, with boys also mentioning nature and wild greenery as positive influences on the game of hide and seek. Spaces that provided hiding places were helpful during hide and seek, but also beneficial for taking some time away from others. In line with research by van den Bogerd and Maas (2024), the pupils from the green schoolyard spent more time discussing the ability to have a calm moment. They connected trees, tunnels, and the treehouse to a calm moment, whereas the pupils in School 2 connected it only to the concept of a hut. Both the concept of ‘hut’ and the separate concept of ‘huts and tunnels’ were mentioned by several girls, suggesting a preference for spaces to sit and take some time away from the schoolyard. This again is in line with the research described earlier.

Other authors described that children, especially boys, can be socially excluded for cross-gendered behaviour (Freeman, 2007; Boyle et al., 2003). This was not found in this thesis, although that does not imply that such social exclusion was absent. During one lunch break, a boy approached the author and asked why she was wearing a blue jacket, when this was a ‘boy colour.’ This was a minor comment, but it highlights that this behaviour occurs within these schoolyards, and that the children might have left it out of the FCM, potentially to adhere to the socially desirable answers.

While results from other studies indicate that conflicts may be more prominent in traditional schoolyards than in green schoolyards, the conflict levels between the two schools seemed relatively similar here (van den Bogerd & Maas, 2024). Three pupils of School 1 mentioned conflict, compared to two pupils in School 2. Interestingly, this suggests that conflict might be more prominent in the green schoolyard, but

the difference is too small to discern any concrete findings. In both schools, swings and the football field (specifically the goalposts in School 2) were seen as sources of conflict. The tumble bars in School 1 and the table-tennis table in School 2 were also seen as conflict-increasing elements. Pupils from School 2 mentioned that additional variation, benches, and different goal posts could help resolve some conflicts. This indicates that it is the more traditional types of equipment that tend to cause arguments, thus aligning with prior research.

Safety

As was expanded upon in Chapter 2, there is significant discourse surrounding safe environments for children and the considerations about risky play. Some children explicitly said they enjoyed playing in a challenging way, whether this was through heights, speed or other factors. For other children, it was more implicit in their story, like in the high climbing equipment concept. Children in both schools had concerns about such equipment, understanding that it could be dangerous. In School 2, these fears were dominant, with many children assigning strong negative values to the wooden climbing equipment. In School 1, more children considered it a learning curve, talking about guiding ropes or avoiding the equipment during rainfall. This concern was echoed by both groups of pupils, who shared the concern that slippery equipment was much less safe. More girls also mentioned this than boys, suggesting that there may be a difference in risk-taking strategies, as found in earlier literature (Isci & Hasirci, 2023).

6.3 The school

Prior research also attributes significant importance to the teacher’s role, although there is much more to be explored. The children, too, felt that their teachers and other staff played a role in their experience, although they discussed this much more briefly than the play-supporting design elements.

Rules and supervision

The pedagogies of the two schools differ significantly, with School 1 adopting an approach with minimal rules and School 2 aiming to resolve conflict by implementing additional rules. This diversity is not uncommon, and the difference in regulation can determine how the children experience their play space (Aminpour et al., 2020). One child mentioned the lack of rules in School 1, explaining that while it made the schoolyard more fun, it also made it less safe. In School 2, the schoolyard was adapted several times, such as the removal of the swings and splitting the football field. This was done to resolve the conflict, as implementing rules had not

been enough to prevent arguments between the pupils. Findings from other research cannot be compared here, such as the finding that boys are more likely to break rules (Aminpour et al., 2020). Nonetheless, the aforementioned study found that girls were often negatively impacted by the consequences, which can be seen in School 2. The removal of the swings had a more negative impact on the girls, and even those who did not play football were often confronted with the conflict arising from the divided pitch.

Education and maintenance

While limited research on children’s experiences of schoolyard maintenance exists, Rigolon et al. (2015) suggest that involving pupils in the regular maintenance could beneficially impact them. These authors suggest that children could feel more connected to nature and to their schoolyard. The findings from this thesis align with this, with several children from School 1 choosing to participate in the maintenance and having significant knowledge on natural elements.

Van Dijk-Wesselius and colleagues found that outdoor learning, whether traditional education outside or more nature-focused, was beneficial. This was echoed by the children in School 1, especially the girls. Not only was this concept explicitly mentioned by several pupils, but the benefits of it seem clear: in School 1, children discussed a much larger number of natural elements. In School 2, no outdoor learning programmes are in place, and the schoolyard does not offer any suitable space to host such activities. The findings from this study thus support earlier studies, which show that children not only enjoy such classes but also benefit educationally.

6.4 The neighbourhood

The level of openness of these schoolyards was of special interest in this thesis, due to the limited available research and the call from the Rotterdam municipality to open up the schoolyard. Two children, both pupils from School 1, explicitly mentioned their open schoolyard, referring to it negatively. Most children instead spoke of fences, with those in School 1 disliking them and those in School 2 assigning them positive values. These values are remarkable, as they contrast with the reality of schoolyards. While most aspects mentioned by the pupils reflect their own schoolyard, the opposite is the case here.

While limited research is available, the point raised by Derr & Rigolon (2016) on the potential dangers of fully open schoolyards is somewhat corroborated here. Although

the dangers discussed in that article are specific to the US context, the principle remains that there are concerns when anyone is able to enter the schoolyard. These concerns are particularly relevant when considering the findings of the second schoolyard, where several children discussed elements such as litter and fear of unknown adults in their schoolyard. Surveillance was considered a solution mostly by the boys from School 2, which is not reflected in the literature. Girls felt that litter was both unsafe and negatively impacted the quality of the schoolyard, while boys only discussed the latter. This could be a sign of different attitudes towards risk, as were identified by Isci and Hasirci (2023).

6.5 Methodological reflection and limitations

The use of fuzzy cognitive mapping in this context, particularly with children, is relatively unique, yielding insights that are not limited to the data but also to the methodology. These will be discussed here, including the limitations and advantages of this method in this research context.

While the method is not new, its use in the field of urban studies remains limited. The majority of existing literature is rather technical, both in terms of chosen topic and writing. This complicated the research process, due to the non-technical focus of this research. The conducted pilots were key in ensuring a relatively smooth fieldwork period, as the implemented adaptations allowed the research process to be more suitable to the children. Furthermore, both the analysis and the presentation of the results can be done in several ways, with many previous studies adopting a rather technical approach. In this thesis, two software programmes (FCMapper and Mental Modeler, supported with RStudio) were used to analyse the data. The choice of these different software was due to their ease of use and various analysis methods, allowing for richer results.

For the presentation of the results, a less technical focus was adopted, prioritising the qualitative aspects of this research. This was combined with technical elements, such as the aggregated maps and the network statistics. While this meant that the quantitative analysis was less in-depth, it was still preferred here. The more qualitative approach allows the results to be clearer to a wider audience, thus being more suitable for school employees and others to easily understand.

Despite using two software programmes, several limitations remain. Wildenberg et al. (2014) highlight that the analysis of FCMs remains especially lacking, with a significant amount of uncertainty remaining. A common challenge is striking a

balance between simplifying the aggregated maps to make them legible without erasing the nuances of the data. This challenge was overcome here by including both a complete aggregated map and a condensed map with the most mentioned concepts. Another difficulty is the ‘controversial’ concepts, to which certain children assign a positive relationship, while others assign a negative one to the same connection. These relationships were combined using a simple average, which can obscure such conflicts. To mitigate this, the strongest conflictual relationships were described in the results section.

While these limitations should not be ignored, the benefits of fuzzy cognitive mapping were considered to outweigh the disadvantages for this thesis. It allows for the rich insights from qualitative methodologies, as well as the more welcoming setting of a verbal interview, which is especially suitable for children. It combines these benefits with those of quantitative methods, allowing for the weighing of different concepts and thus enabling the discernment of priorities.

Although Rotterdam is a relatively unique city within the Netherlands, the case may reflect other medium-sized cities internationally. The sample studied here is diverse, representing many of the country’s major ethnic groups. However, although Rotterdam may be relatively hostile to children’s independent mobility compared to other Dutch cities, this might be representative of other countries, where fewer pupils can walk to school independently. Nonetheless, concerns about gender dynamics in schoolyards, a lack of outdoor play, and minimal access to nature are present in many countries, highlighting the need for further research.

6.6 Future research

Especially interesting could be to conduct this research again, but in two phases. First, the FCMs could be conducted similarly to this study, after which the children would visit the other school, and the same FCMs would be conducted again. This could provide more insight into their preferences, not only by accounting for the bias towards their surroundings but also by researching if one trip would be enough to counter this bias at least somewhat. This would be particularly insightful if two distinct schoolyards were used, as was done here.

Another avenue for future research is the further exploration of fuzzy cognitive mapping with children. This could be in various contexts, as the method showed significant potential during this research. It could be valuable to explore how different age groups react to the method, or if the differences between boys and girls in their network complexities appear in other studies as well.

6.7 Future recommendations

In line with the findings from this study, particularly those from the scenario analysis, a set of recommendations arises for schoolyard design. These are not conclusive, but they are meant to indicate potentially relevant factors.

The opening up of schoolyards has gained significant popularity, with municipalities and researchers enthusiastically promoting this (Sekulova & Ruíz Mallén, 2023). This shift should not be discredited, but it is necessary to be cautious when opening up schoolyards. The results from this research highlight that, although highly context-dependent, completely open schoolyards may be less attractive to children and perceived as dangerous. Even if this danger is merely perceived, it remains essential to address, as children’s safety perceptions will play a significant role in whether they enjoy playing outside. Nonetheless, open schoolyards are often beneficial in several ways, for the children and the wider neighbourhood. This nuance necessitates a compromise, of which School 1 is a good example. While its fenced area allows teachers to keep an eye on the children and have more control over how the schoolyard is used, its supervised openness means that many of the benefits of a fully open schoolyard can still be enjoyed.

Moreover, it is not merely the design of the schoolyard and its elements that should be considered. The role of the teacher is key in this, as well as the role of the school. Different rules and different styles of supervision can change a schoolyard completely, without physical intervention. It is more so a call to reassess these rules and understand their impacts. A combination of well-considered rules, active supervision and designed-in risk could allow pupils to learn their own strengths and limitations in play, without risking significant harm. Nature education, or outdoor learning, is another factor that does not need to be embedded in the design, although this could be beneficial, and positively impacts the pupils in several ways.

The factors above are of significant importance but should not be implemented without including children’s voices in the process. This research follows many others in highlighting how well children are informed about their environment, and how they strongly consider elements like safety and the well-being of others. The complexity of these maps, both in the diversity of elements as well as the connections between them, shows that these children understood their schoolyard as a space influenced by both social and physical elements. The children are not only the primary users of their schoolyard, but also knowledgeable and should be included in planning processes. The scenarios highlight that the number of variables impacted by a change of even one variable, thus requiring careful consideration and an ability to adjust the design afterwards.

7. CONCLUSIONS

7. CONCLUSIONS

This thesis set out to explore children’s perceptions about their schoolyards, aiming to understand what affected their quality and safety experiences. This exploration was done while considering three scales: the schoolyard, the school and the neighbourhood. This multi-scalar approach has allowed for a more complex reflection on children’s spaces, increasing understanding on the intricacies of schoolyards. The methodology of fuzzy cognitive mapping was adapted to be child-friendly, resulting in rich results, both quantitatively and qualitatively. The results highlight that these children were excited to participate, with most children enthusiastically sharing their thoughts. The research questions are reflected upon using these results, after which the limitations and future directions are discussed.

- What is the design of these schoolyards?

Understanding the design of the schoolyards was crucial in this research, as this design shaped the children’s perceptions. The comparison between an open, concrete schoolyard with a closed, green schoolyard highlighted this, with many children mentioning elements present in their own schoolyard. Perhaps the most striking example of this is the number of natural elements mentioned in the different schools, with ten elements being mentioned in the green schoolyard and three in the concrete schoolyard.

- **How do children perceive the design of their schoolyards?**

This familiarity bias is one of many factors that influence how children perceive the design of their schoolyards. It is not surprising that the children spoke at length about equipment, including swings and climbing equipment. However, for them the schoolyard was much more than the affordances offered by manufactured equipment. Some children described using equipment for other types of play, like playing round-the-table on a table tennis table, while others used tunnels and treehouses to find a calm moment. Activities like hide and seek, tag and outdoor education might not be in the built form of the schoolyard, but was crucial to the pupils. Furthermore, conflict and friendship significantly influenced the children, indicating that the social sphere of the schoolyard is key. This extends to the role of teachers and parents, whose supervision was believed to influence children’s behaviour.

- How are these perceptions gendered?

Comparing the perceptions of the boys and girls, it is evident that these perceptions are at least partially gendered. The aggregate maps differed not only in terms of content, but also in terms of complexity. This suggests that girls focus on different

elements than boys but also consider more elements and more interconnections. In line with earlier research, this thesis found that boys and girls tended to prefer different activities, with football being preferred by boys and girls favouring activities like tumble bars (Reimers et al., 2018). Elements like climbing equipment and swings were previously identified as more ‘gender neutral’, which was largely reflected in this thesis (Barenie et al., 2024). Gender-stereotypical dynamics might also be less present in green schoolyards (Nicksic et al., 2018), allowing girls to be more physically active and feel more comfortable in the space. While physical activity was not studied in this thesis, it is evident that girls enjoy natural spaces and a wide array of natural elements. This thus supports prior research. Safety was more central in the female aggregated map, indicating that safety perceptions are also gendered. Moreover, boys were more focused on elements like surveillance and fences, where girls discussed litter and slippery equipment. This aligns with existing research that indicated different risk-taking strategies for boys and girls (Isci & Hasirci, 2023). These findings provide further insights into the gender dynamics in schoolyards, illustrating the importance of green elements in countering this.

- Does the openness of a schoolyard impact the children’s perceptions?

This thesis identified openness as an important factor in children’s perceptions, although this differed between the two schools. Some children in School 1, the enclosed schoolyard, disliked the fences and preferred a more open schoolyard, while classmates favoured these fences and would prefer the schoolyard to remain closed after hours. Contrastingly, most children from School 2, the open schoolyard, preferred having more fencing. These pupils were concerned about the ease of accessibility, due to the increased presence of strangers and litter. This suggests that opening up schoolyards could be beneficial, but the scale of the neighbourhood should be considered and children should be protected from harmful elements.

The focus of this thesis was on gaps in existing literature, such as openness, which indeed were found to be important for the children. However, the implications of this thesis extend beyond these research gaps. The findings, particularly from the scenario approach, highlight that schoolyards are complex spaces, where changing one element could have unexpected consequences. While the scenarios modelled here only included three adjusted elements, nearly all variables were impacted. This is emblematic of the intricacies of schoolyards, and should be considered in future adjustments of schoolyards. As indicated in Chapter 3, this is further complicated by wider urban dynamics, with access to green schoolyards often unequal (Gallez et al, 2024).

The present thesis was subject to several limitations. These limitations include a limited sample size, the adaptation of FCM for children and the lack of information on ethnicity and other factors. It could be beneficial for future research to adapt FCM further, include more participants and collect more data on the individual children. Despite the exploratory nature of this thesis, it offers insights into children’s perceptions, as well as methodological reflections about FCM. Children are not merely the ‘canaries in our mines’ or an ‘indicator species’, they are much more than that. This was evident during the data collection, where the children enthusiastically participated and shared their nuanced opinions. Their combined insights point out that schoolyard design is not solely about equipment or a space during lunch break. The move towards green and open schoolyards is representative of a much wider shift, towards nature and co-creation of spaces. This transition is admirable, but can only be done correctly if children are recognised for their insights and can truly participate.

8. BIBLIOGRAPHY

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